APPENDIX F

Section 303(d) Waters

1998 303(d) List

CATEGORY 1
RECOMMENDED SECTION 303(d) WATERS REQUIRED TO HAVE TMDLS

Water	County	Miles/Acres Affected***	Pollutant	Source
Streams/Rivers				
1529 Little Beaver Creek	Phelps	0.1	NFR	Rolla SW WWTP
1746 Big Bottom Creek	Ste. Genevieve	0.5	BOD, NFR	Lake Forest Subdivision
2916 Big Creek	Iron	4	Metals	Doe Run Lead smelter
1224 Big Otter Creek	Henry/St. Clair	1	pH	Otter Creek AML
2074 Big River	Jefferson	53	Lead	Old Lead Belt AML
2080 Big River	St. Francis	40	Lead, sediment	Old Lead Belt AML
2755 W. Fk. Black River	Reynolds	0.2	Nutrients	Doe Run W. Fork Mine
0811 E. Brush Creek	Moniteau	1	Nutrients	California N. WWTP
1370 Brush Creek	St. Clair	1	Inundation	Truman Dam
1592 Brushy Creek	Texas	0.2	NFR	Houston WWTP
0859 Brushy Fork	Pettis	1	BOD, NFR, NH_3N	Sedalia Central WWTP
3269, 3273 Buffalo Creek	McDonald	15.5	Nutrients	Livestock production
3118 Buffalo Ditch	Dunklin	2	BOD	Kennett WWTP
0709 Bynum Creek	Callaway	0.3	Sediment	Auxvasse Stone Quarry
9000 Cave Spring Branch	McDonald	0.2	Nutrients	Livestock/Simmons
0737 Cedar Creek	Callaway	2	pH, sulfate	Cedar Creek AML
		1	Sulfate	Cedar Creek AML
		1	Sulfate	Manacle, Cross-Mitchell AMLs
3203 Center Creek	Jasper	11	Zinc	Tristate AML
0640 Chariton River	Chariton	29	Fecal coliform	Unknown
3168 Chat Creek	Lawrence	2	Zinc	Aurora AML
3238 Clear Creek	Newton	1	BOD, NFR, NH_3N	Monett WWTP
3239 Clear Creek	Barry/Lawrence	2	BOD, NFR, NH_3N	Monett WWTP
0690 Dark Creek	Randolph	8	Sulfate	Crutchfield AML
0912 Davis Creek	Lafayette	2	BOD, Nutrients	Odessa SE WWTP
0510 Dog Creek	Daviess	0.2	Sediment	Traeger Quarry
1145 Dry Auglaize Creek	Laclede	1.5	BOD, NFR	Lebanon WWTP
2604 Eleven Point River	Howell	0.4	Chlorine	Willow Springs WWTP
3246 Elk River	McDonald	21.5	Nutrients	Livestock production
2168 Flat River Creek	St. Francis	5	Lead, sediment, zinc	Old Lead Belt AML
2860 Goose Creek	Madison	0.5	Nickel	Madison mine outflow
0883 Gabriel Creek	Morgan	1.1	BOD, NFR	Stover NW WWTP, Stover SW WWTP
1007 Hinkson Creek	Boone	6	Unspecified	Urban nonpoint source
1008 Hinkson Creek	Boone	5	Unspecified	Urban nonpoint source
1251 Honey Creek	Henry	3	Sulfate	Reliant AML
2582 Howell Creek	Howell	0.3	Chlorine	West Plains WWTP
3256 Indian Creek	McDonald/Newton	26	Nutrients	Livestock production
3262, 3263 M. Indian Cr.	Newton	5.5	Nutrients	Livestock production
3260 N. Indian Creek	Newton	5	Nutrients	Livestock production
3259 S. Indian Creek	Newton	9	Nutrients	Livestock production

Water	County	Miles/Acres Affected***	Pollutant	Source
Streams/Rivers (cont.)				
2681 Jacks Fork River	Shannon	5	Fecal coliform	Organic wastes
2347, 2362, 2365 James River	Greene/Stone/ Christian	58.5	Nutrients, unknown	Urban point & nonpoint source
1016 Kelley Branch	Boone	1	Habitat loss	ORV use Finger Lakes State Park
1438 Little Lindley Creek	Dallas	1	BOD, NFR	Buffalo WWTP
0427 E. Fk. Little Blue R.	Jackson	0.1	BOD, NFR	Independence MHP
0535 Long Creek	Caldwell	0.2	Sediment	Everett #6 Quarry
2814 Main Ditch	Butler	5	BOD, NFR	Poplar Bluff WWTP
0742 Manacle Creek	Callaway	2	pH, sulfate	Manacle Creek AML
1308 Marmaton River	Vernon	49.5	Not stated	Natural background
2787 McKenzie Creek	Wayne	0.5	pH	Gads Hill Quarry
1234 Monegaw Creek	St. Clair	3	Sulfate	Montee AML
0942 N. Moreau Creek	Moniteau	10	Susp. Algae	California S. WWTP
1300 Mound Branch	Bates	1	BOD	Butler WWTP
0856 L. Muddy Creek	Pettis	0.7	Temperature	Tyson's Foods Inc.
0855 Muddy Creek	Pettis	33	BOD	Sedalia Central WWTP
3490 Trib. L. Muddy Creek	Pettis	0.4	Temperature, NH_3N	Tyson's Foods Inc.
1305 Mulberry Creek	Bates	8	Sulfate	Mulberry Creek AML
3652 Little Osage River	Vernon	16	Not stated	Natural background
1310 Little Osage River	Vernon	6.3	Not stated	Natural background
1031 Osage River	Miller/Cole	0.4	Habitat loss	Capital Sand&Gravel, Osage S&G
3268 Patterson Creek	McDonald	2	Nutrients	Livestock production
2373 Pearson Creek	Greene	1.5	Unknown toxicity	Unknown
2614 Piney Creek	Oregon	0.1	Chlorine	Alton WWTP
1714 Rock Creek	Jefferson	2	BOD, NH_3N	2 WWTPs
1014 Rocky Fork	Boone	0.5	Sediment	Finger Lakes AML
0278 Rush Cr.	Platte	0.2	BOD, NFR	Platte Co. Sewer Dist. #7 WWTP
1381 L. Sac River	Greene/Polk	27	Fecal coliform	Springfield NW WWTP
2859 Saline Creek	Madison	0.5	Nickel	Madison mine outflow
2190 Saline Creek	Jefferson	2	BOD, NH_3N	Ron Rog WWTP, Hwy 141 WWTP
0091 Salt River	Ralls	29	Manganese,Iron,Low D.O.	Cannon Dam
0103 Salt River	Ralls/Pike	10	Low D.O., Manganese	Cannon Dam
1319 Second Nicholson Creek	Barton	3	Sulfate	Many AML areas
2170 Shaw Branch	St. Francis	2	Sediment	Federal AML
2120 Shibboleth Creek	Washington	0.5	Sediment	Barite tailings pond
3230 Shoal Creek	Barry/Newton	13.5	Fecal coliform	Unknown ag. sources
0400 W. Fk. Sni-a-Bar Cr.	Jackson	0.2	BOD, NFR	Lake Lotawana WWTP
2835 St. Francis River	St. Francis	3	NH_3N, BOD	Farmington W. WWTP
1361 Stockton Branch	Cedar	2	Susp. Algae	Stockton WWTP
0959 Straight Fork	Morgan	2	Susp. Algae	Versailles WWTP
3250 B. Sugar Creek	McDonald/Barry	31	Nutrients	Livestock production
3249 L. Sugar Creek	McDonald	11	Nutrients	Livestock production
0686 Sugar Creek	Randolph	1	pH	Huntsville AML
		0.5	pH	Calfee Mine Flow

Water	County	Miles/Acres Affected***	Pollutant	Source
Streams/Rivers (cont.)				
1282 E. Fk. Tebo Creek	Henry	1	pH	Triple Tipple AML
1284 M. Fk. Tebo Creek	Henry	5.5	Sulfate	Newcastle Tipple AML, other AML
1288 M. Fk. Tebo Creek	Henry	2	pH, sulfate	Newcastle Tipple AML
		1.5	Sulfate	Newcastle Tipple AML
1292 W. Fk. Tebo Creek	Henry	7	Sulfate	Spargler AML
2850 Trace Creek	Madison	4.2	pH	Unknown
		1.3	pH	Unknown, sawdust pile leachate
1211 Trib. Barker's Creek	Henry	0.3	pH, sulfate	Grey AML
1225 Trib. Big Otter Creek	Henry/St. Clair	1	pH	Otter Creek AML
2128 Trib. Pond Creek	Washington	0.5	Sediment	Barite tailings pond
3217 Turkey Creek	Jasper	5	Zinc	Duenweg AML
3216 Turkey Creek	Jasper	3.5	Zinc	Duenweg AML
		4	PCP	Joplin Turkey Crk WWTP
		4	BOD, NFR	Joplin Turkey Crk WWTP
3282 Turkey Creek	St. Francis	1.5	BOD, NFR	Bonne Terre WWTP
2864 Village Creek	Madison	0.5	Sediment	Mine la Motte AML
1505 Whetstone Creek	Wright	2	BOD	2 Mountain Grove WWTPs
2375 Wilson Creek	Greene/Christian	18	Unknown toxicity	Urban nonpoint source
Lakes				
7119 Cameron Lower Lake	DeKalb	96	Atrazine	Corn, sorghum production
7120 Cameron Lake #1	DeKalb	25	Atrazine	Corn, sorghum production
7121 Cameron Lake #2	DeKalb	35	Atrazine	Corn, sorghum production
7237 Fellows Lake	Greene	820	Nutrients	Ag/suburban nonpoint source
7124 Hamilton Lake	Caldwell	80	Cyanazine	Corn, sorghum production
7190 Higginsville S. Lake	Lafayette	223	Atrazine	Corn, sorghum production
7022 LaBelle Lake #1	Lewis	17	Atrazine	Corn, sorghum production
7023 LaBelle Lake #2	Lewis	112	Atrazine	Corn, sorghum production
7205 Lake of the Ozarks	Benton	50	Low D.O.	Truman Dam
			Gas supersaturation	Truman Dam
			Fish trauma	Truman Dam
7314 Lake Taneycomo	Taney	1,730	Low D.O.	Table Rock Dam
7356 Lamar Lake	Barton	180	Nutrients	Ag nonpoint source
7033 Mark Twain Lake	Ralls	18,600	Atrazine	Corn, sorghum production
7236 McDaniel Lake	Greene	300	Nutrients	Ag/suburban nonpoint source
7031 Monroe City Route J Lake	Ralls	94	Atrazine	Corn, sorghum production
			Cyanazine	Corn, sorghum production
7187 Spring Fork Lake	Pettis	178	Algae	Ag nonpoint source
7077 Smithville Lake	Clay	7,190	Atrazine	Corn, sorghum production
7207 HS Truman Lake	Bates/Benton	55,600	Manganese	Natural
7032 Vandalia Lake	Pike	37	Atrazine	Corn, sorghum production

CATEGORY 2
RECOMMENDED SECTION 303(d) WATERS REQUIRED TO HAVE ADDITIONAL MONITORING PRIOR TO TMDL DEVELOPMENT

Water	County	Miles/Acres Affected***	Pollutant	Source
Streams/Rivers				
1250 Big Cr.	Cass/Henry	49	Sediment*	Ag nonpoint source
0449 W. Fk. Big Cr.	Harrison	18	Sediment	Ag nonpoint source
0436 Big Muddy Cr.	Daviess	8	Sediment *+	Ag nonpoint source
0653 Blackbird Cr.	Putnam/Adair	10.5	Sediment+	Ag nonpoint source
0921 S. Fk. Blackwater	Johnson	5	Sediment*	Ag nonpoint source
1336 Clear Cr.	Vernon	18	Sediment+	Ag nonpoint source
0372 E. Fk. Crooked Cr.	Ray	14	Sediment	Ag nonpoint source
1325 L. Drywood Cr.	Vernon	17	Sediment	Ag nonpoint source
0189 Elkhorn Cr.	Montgomery	0.5	Sediment	Ag nonpoint source
0056 N. Fabius R.	Marion/Schuyler	82	Sediment	Ag nonpoint source
0865 Flat Cr.	Pettis	20	Sediment+	Ag nonpoint source
0457 E. Fk. Grand R.	Worth/Gentry	25	Sediment	Ag nonpoint source
0468 M. Fk. Grand R.	Worth/Gentry	25	Sediment+	Ag nonpoint source
0502 Grindstone Cr.	Clinton/DeKalb	16	Sediment	Ag nonpoint source
0337 Honey Cr.	Nodaway	8.5	Sediment	Ag nonpoint source
0554 Honey Cr.	Livingston	23	Sediment	Ag nonpoint source
0212 Indian Camp Cr.	Warren	5	Sediment	Ag nonpoint source
0875 Lake Cr.	Pettis	15	Sediment	Ag nonpoint source
3105 Lat.#2 Main Ditch	Stoddard	11.5	Sediment *	Ag nonpoint source
0606 Locust Cr.	Putnam/Chariton	84	Sediment	Ag nonpoint source
0612 W. Fk. Locust Cr.	Sullivan/Linn	17	Sediment+	Ag nonpoint source
0339 Long Branch	Nodaway	6	Sediment	Ag nonpoint source
0508 Marrowbone Cr.	Daviess	11	Sediment	Ag nonpoint source
0619 E. Fk. Medicine Cr.	Putnam/Grundy	36	Sediment *+	Ag nonpoint source
0623 L. Medicine Cr.	Mercer/Grundy	40	Sediment *+	Ag nonpoint source
1299 Miami Cr.	Bates	18	Sediment	Ag nonpoint source
0159 Mill Creek	Lincoln	4	Sediment	Ag nonpoint source
0001 Mississippi River	Clark-St. Charles	165	Habitat loss	Channelization
1707 Mississippi River	St. Charles-Mississippi	200.5	Habitat loss	Channelization
3152 Mississippi River	Mississippi-Pemiscot	124.5	Habitat loss	Channelization
0226 Missouri River	Atchison-Jackson	179	Habitat loss	Channelization
0356 Missouri River	Jackson-Chariton	125	Habitat loss	Channelization
0701 Missouri River	Chariton-Gasconade	129	Habitat loss	Channelization
1604 Missouri River	Gasconade-St. Charles	100	Habitat loss	Channelization
0345 White Cloud Cr.	Andrew/Nodaway	11	Sediment	Ag nonpoint source
0674 Mussel Fork	Sullivan/Macon	29	Sediment+	Ag nonpoint source
1175 W. Fk. Niangua R.	Webster	0.5	BOD,NFR	Marshfield WWTP
0081 North R.	Marion/Shelby	40	Sediment	Ag nonpoint source
3041 Old Ch. Little R.	New Madrid	20	Sediment *	Ag nonpoint source
		3.5	Sediment	Ag nonpoint source
1444 Piper Cr.	Polk	0.5	NFR	Bolivar WWTP
0327 3rd Fk. Platte R.	Gentry/Buchanan	31.5	Sediment	Ag nonpoint source
0121 M. Fk. Salt R.	Monroe/Macon	49	Sediment	Ag nonpoint source
3134 Spillway Ditch	Mississippi/NewMadrid	13.5	Sediment*	Ag nonpoint source
0657 Spring Cr.	Sullivan/Adair	18	Sediment+	Ag nonpoint source
1870 Spring Cr.	Dent	0.3	BOD, NFR	Salem WWTP

Water	County	Miles/Acres Affected***	Pollutant	Source
Streams/Rivers (cont.)				
3188 N. Fk. Spring R.	Dade/Jasper	51.5	Sediment	Ag nonpoint source
0710 Stinson Cr.	Callaway	0.5	BOD, NH_3N, NFR	Fulton WWTP
0248 L. Tarkio Cr.	Holt	17.5	Sediment+	Ag nonpoint source
0073 Troublesome Cr.	Marion	3.5	Sediment+	Ag nonpoint source
1339 Walnut Cr.	Cedar	1.0	BOD,NFR	El Dorado Spgs. WWTP
0050 S. Wyaconda R.	Clark/Scotland	9.0	Sediment+	Ag nonpoint source
Lakes				
7171 Long Branch Lake	Macon	2430	Cyanazine	Corn, sorghum production
7009 Wyaconda Lake	Clark	8	Atrazine	Corn, sorghum production

* stream has significant amounts of channelization
+ large Concentrated Animal Feeding Operations in this watershed

CATEGORY 3
RECOMMENDED SECTION 303(d) WATERS REQUIRED TO HAVE USE ATTAINABILITY ANALYSES OR TMDL DEVELOPMENT

Water	County	Miles/Acres Affected***	Pollutant	Source
Streams/Rivers				
0417 Blue River	Jackson	4	Chlordane	Urban nonpoint sources
0418 Blue River	Jackson	9	Chlordane	Urban nonpoint sources
0419 Blue River	Jackson	9	Chlordane	Urban nonpoint sources
0421 Blue River	Jackson	2	Chlordane	Urban nonpoint sources
0037 Fox River	Clark	12	Sediment	Ag nonpoint source
0046 Wyaconda River	Lewis	8	Manganese	Natural
0063 M. Fabius River	Lewis	57	Manganese	Natural
Lakes				
7255 Creve Coeur Lake	St. Louis	300	Chlordane	Urban nonpoint source
7054 Lake St. Louis	St. Charles	525	Chlordane	Urban nonpoint source
7211 Pleasant Hill Lake	Cass	115	Chlordane	Unknown
7207 Truman Lake	Bates-Benton	55,600	Manganese	Natural

Notes:

******* **Units are in miles for streams and surface acres for lakes.**

Abbreviations:
AML Abandoned mined land
BOD Biological oxygen demand
D.O. Dissolved oxygen
NFR Non-filterable residue
NH_3N Ammonia
pH Acidic conditions
PCP Pentachlorophenol
WWTP Wastewater treatment plant

APPENDIX G

Streams Designated for Cold Water Fisheries

Streams Designated for Cool Water Fisheries

Outstanding National Resource Waters

Outstanding State Resource Waters

Table 17. STREAMS DESIGNATED FOR COLD-WATER SPORT FISHERY

Waterbody	Miles	From	To	County(ies)
Barren Fork	2	Mouth	20,31N,4W	Shannon
Bee Creek	1	Mouth	Hwy. 65	Taney
Bender Creek	0.7	Mouth	10,31N,9W	Texas
Bennett Springs Creek	2	Mouth	Bennett Springs	Laclede
Blue Springs Creek	4	Mouth	2,39N,3W	Crawford
Bryant Creek	1	3,23N,12W	34,24N,12W	Ozark
Bryant Creek	6	19,27N,14W	8,27N,15W	Douglas
Buffalo Creek	10	State line	5,23N,33W	McDonald
Bull Creek	5	Mouth	34,24N,21W	Taney
Capps Creek	4	Mouth	17,25N,28W	Newton-Barry
Cedar Creek	1	21,26N,32W	28,26N,32W	Newton
Center Creek	3	24,27N,29W	17,27N,28W	Lawrence
Chesapeake Creek	3	Mouth	29,28N,25W	Lawrence
Crane Creek	15	8,25N,23W	23,26N,25W	Stone-Lawrence
Current River	19	24,31N,6W	Montauk Spring	Shannon-Dent
Dogwood Creek	2.3	Mouth	State line	Stone
Dry Creek	4	Mouth	14,37N,3W	Crawford
Eleven Point River	33.5	State line	36,25N,4W	Oregon
Flat Creek	3	9,23N,27W	21,23N,27W	Barry
Goose Creek	4	Mouth	10,28N,25W	Lawrence
Greer Spring Branch	1	Mouth	36,25N,4W	Oregon
Hickory Creek	4.5	13,25N,31W	28,25N,31W	Newton
Hobbs Hollow	2.7	Mouth	State line	Stone
Horse Creek	2.2	Mouth	23,35N,8W	Dent
Hunter Creek	5	22,26N,15W	20,26N,14W	Douglas
Hurricane Creek	1.5	Mouth	30,24N,12W	Ozark

Waterbody	Miles	From	To	County(ies)
Hurricane Creek	3.2	Mouth	22,25N,3W	Oregon
Indian Creek	1.4	Mouth	17,21N,23W	Stone
Johnson Creek	3	Mouth	36,29N,26W	Lawrence
Joyce Creek	1	17,24N,28W	16,24N,28W	Barry
L. Flat Creek	3.5	Mouth	25,25N,27W	Barry
L. Piney Creek	15	25,37N,9W	4,35N,8W	Phelps
L. Piney Creek	19	25,37N,9W	31,37N,8W	Phelps
L. Sinking Creek	2.2	Mouth	33,32N,4W	Dent
Lyman Creek	1	Mouth	30,40N,3W	Crawford
Maramec Spring Branch	1	Mouth	1,37N,6W	Phelps
Meramec River	10	22,38N,5W	Hwy. 8	Crawford
Mill Creek	1.5	Mouth	9,36N,18W	Dallas
Mill Creek	5	29,37N,9W	Yelton Spring	Phelps
Mill Creek	1.5	Mouth	11,40N,8W	Maries
N. Fork White River	13.5	3,22N,12W	28,24N,11W	Ozark
Niangua River	6	11,35N,18W	Bennett Sp. Creek	Dallas
Roaring River	7	Mouth	34,22N,27W	Barry
Roark Creek	3	Mouth	36,23N,22W	Taney
Roubidoux Creek	4	Mouth	25,36N,12W	Pulaski
S. Indian Creek	3.4	30,24N,30W	1,23N,30W	Newton-McDonald
Schafer Spring Creek	2	Mouth	20,32N,6W	Dent
Shoal Creek	1	Mouth	18,41N,17W	Morgan
Shoal Creek	7	09,25N,29W	16, 22N, 21W	Newton
Spring Branch	1	Mouth	18,41N,17W	Morgan
Spring Creek	6.5	Mouth	31,35N,9W	Phelps
Spring Creek	2.5	Mouth	4,41N,2W	Franklin

Waterbody	Miles	From	To	County(ies)
Spring Creek	5.5	Mouth	12,26N,24W	Stone
Spring Creek	3	Mouth	5,24N,13W	Douglas-Ozark
Spring Creek	2.5	Mouth	26,25N,11W	Douglas
Spring Creek	5	Mouth	14,23N,11W	
Spring Creek	4	Mouth	30,25N,4W	Oregon
Spring River	11.2	13,27N,27W	20,26N,26W	Lawrence
Stone Mill Spring Branch	0.2	Mouth	Spring	Pulaski
Taneycomo, Lake	1730 ac.	8,23N,20W	---	Taney
Terrell Creek	2	Mouth	2,27N,23W	Christian
Tory Creek		Mouth	27,26N,22W	Stone-Christian
Turkey Creek	2	Mouth	16,22N,21W	Taney
Turkey Creek	1	Mouth	17,23N,15W	Ozark
Turnback Creek	14	35,30N,26W	24,28N,25W	Dade-Lawrence
Warm Fork Spring River	3	6,22N,5W	30,23N,5W	Oregon
Whittenburg Creek	2.5	Mouth	Hwy. 8	Crawford
Williams Creek	1	Mouth	28,28N,27W	Lawrence
Woods Fork Bull Creek	1	15,25N,21W	15,25N,21W	Christian
Yadkin Creek	3	Mouth	9,37N,4W	Crawford
Yankee Branch	1	Mouth	10,36N,4W	Crawford

Table 18. STREAMS DESIGNATED FOR COOL-WATER FISHERY

Waterbody	Class	Miles	County
Bank Br.	C	5.0	Camden
Barren Fk.	P	6.0	Miller
Beaver Cr.	P	44.5	Taney
Beaver Cr.	P	22.0	Wright
Bee Fk.	C	8.5	Reynolds
Big Barren Cr.	C	19.0	Ripley
Big Cr.	P	32.0	Wayne
Big Cr.	C	27.0	Shannon
Big Piney R.	P	99.0	Pulaski
Big R.	P	53.0	Jefferson
Big Sugar Cr.	P	31.0	McDonald
Black R.	P	26.0	Reynolds
Black R.	P	45.0	Butler
Black R.	P	35.0	Butler
Bourbeuse R.	C	9.0	Phelps
Bourbeuse R.	P	132.0	Franklin
Brushy Fk.	C	5.0	Miller
Bryant Cr.	P	43.0	Ozark
Bryant Cr.	P	13.5	Ozark
Buffalo Cr.	P	5.5	Newton
Buffalo Cr.	P	10.0	McDonald
Buffalo Cr.	P	5.0	Ripley
Bull Cr.	P	17.5	Taney
Butler Cr.	P	3.5	McDonald
Cane Cr.	P	23.0	Butler
Cane Cr.	C	3.0	Taney
Cane Cr.	C	15.0	Butler
Castor R.	P	59.5	Bollinger
Center Cr.	P	26.0	Jasper
Clark Cr.	P	10.0	Wayne
Courtois Cr.	P	30.0	Crawford
Courtois Cr.	C	1.5	Washington
Crooked Cr.	P	3.5	Crawford
Crooked Cr.	P	18.0	Crawford
Current R.	P	118.0	Ripley
Eleven Point R.	C	34.0	Oregon
Eleven Point R.	P	19.0	Oregon
Eleven Point R.	P	21.0	Oregon
Elk R.	P	21.5	McDonald
Finley Cr.	P	44.0	Stone
Flat Cr.	P	7.5	Barry
Flat Cr.	P	39.0	Stone
Fourche Cr.	P	14.0	Ripley
Gasconade R.	P	249.0	Gasconade
Greasy Cr.	P	4.0	Dallas
Greasy Cr.	C	10.5	Dallas
Hog Cr.	P	4.5	Texas

Waterbody	Class	Miles	County
Huzzah Cr.	P	34.0	Crawford
Indian Cr.	C	3.0	Washington
Indian Cr.	P	26.0	McDonald
Jacks Fk.	P	39.0	Shannon
James R.	P	28.0	Stone
James R.	P	26.0	Stone
James R.	P	35.0	Greene
Jones Cr.	P	7.0	Jasper
L. Black R.	P	16.0	Butler
L. Maries Cr.	P	7.0	Osage
L. N. Fk. White R.	P	5.0	Ozark
L. N. Fk. White R.	C	6.0	Ozark
L. Piney Cr.	P	6.0	Phelps
L. Sac R.	P	29.0	Polk
L. Sugar Cr.	P	11.0	McDonald
L. Tavern Cr.	C	4.0	Miller
Limestone Cr.	P	7.0	Dade
Lost Cr.	P	8.5	Newton
Lost Cr.	P	7.0	Warren
Mahans Cr.	P	4.0	Shannon
Marble Cr.	P	14.5	Madison
Maries R.	P	41.5	Osage
Meramec R.	P	10.0	Crawford
Meramec R.	P	26.0	St. Louis
Meramec R.	P	35.0	Crawford
Meramec R.	C	4.0	Dent
Meramec R.	P	75.0	Franklin
Meramec R.	P	37.0	Jefferson
Middle Fk. Black R.	P	15.0	Reynolds
Middle Fk. Black R.	C	1.0	Iron
Mineral Fk.	P	15.0	Washington
N. Fk. White R.	P	28.0	Douglas
Niangua R.	P	6.0	Dallas
Niangua R.	P	51.0	Dallas
Niangua R.	P	24.0	Dallas
Osage Fk.	P	69.0	Laclede
Peno Cr.	C	11.0	Pike
Pike Cr.	P	3.0	Carter
Roubidoux Cr.	C	20.0	Pulaski
Roubidoux Cr.	P	18.0	Pulaski
S. Fk. Buffalo Cr.	C	4.0	Ripley
S. Fk. Buffalo Cr.	P	2.0	Ripley
S. Fk. Saline Cr.	P	20.5	Perry
Saline Cr.	P	12.0	Ste. Genevieve
Shoal Cr.	P	13.5	Newton
Shoal Cr.	P	43.5	Newton
Sinking Cr.	P	21.0	Shannon
Spring R.	P	58.5	Jasper
Spring R.	P	0.5	Jasper
St. Francis R.	P	86.0	Wayne
Stouts Cr.	P	9.0	Madison

Waterbody	Class	Miles	County
Strother Cr.	P	7.0	Reynolds
Swan Cr.	P	29.5	Taney
Tavern Cr.	C	8.0	Miller
Tavern Cr.	P	37.0	Miller
Terre Bleue Cr.	P	4.5	St. Francois
Trace Cr.	P	4.0	Wayne
Twelve Mile Cr.	C	6.0	Madison
Twelve Mile Cr.	P	7.5	Madison
W. Fk. Black R.	P	27.0	Reynolds
W. Fk. Fourche Cr.	C	2.0	Ripley
W. Fk. Fourche Cr.	P	9.0	Ripley
Whetstone Cr.	P	13.0	Wright
Whitewater R.	P	14.0	Bollinger

Table 19. OUTSTANDING NATIONAL RESOURCE WATERS

Stream	**Location**
Current River	Headwaters to Northern Ripley Co. Line
Jacks Fork River	Headwaters to Mouth
Eleven Point River	Headwaters to Hwy. 142

Table 20. OUTSTANDING STATE RESOURCE WATERS

Waterbody	Miles/Acres	Location	County(ies)
Baker Branch	4 mi.	Taberville Prairie	St. Clair
Bass Creek	1 mi.	in Three Creek Conservation Area	Boone
Big Buffalo Creek	1.5 mi.	Big Buffalo Creek Conservation Area	Benton-Morgan
Big Creek	5.3 mi.	Sam A. Baker State Park	Wayne
Big Sugar Creek	7 mi.	Cuivre River State Park	Lincoln
Big Lake Marsh	150 ac.	Big Lake State Park	Holt
Blue Springs Creek	4 mi. (1.5 mi. adjacent to owned lands)	Blue Spring Creek Conservation Area	Crawford
Bonne Femme Creek	2 mi.	Three Creeks Conservation Area	Boone
Brush Creek	0.7 mi	Bonanza Conservation Area	Caldwell
Bryant Creek	1.5 mi.	Bryant Creek Natural Area in Rippee Conservation Area	Ozark-Douglas
Cathedral Cave Branch	5 mi.	Onondaga Cave State Park	Crawford
Chariton River	9.8 mi.	Rebels Cove Conservation Area	Putnam-Schuyler
Chloe Lowry Marsh	40 ac.	Chloe Lowry Marsh Conservation Area	Mercer
Coakley Hollow	1.5 mi.	Lake of the Ozarks State Park	Camden
Coonville Creek	2 mi.	St. Francois State Park	St. Francois
Courtois Creek	12 mi.	Mouth to Hwy. 8	Crawford
Crabapple Creek	1.0 mi.	Bonanza Conservation Area	Caldwell
Devils Ice Box Cave Branch	1.5 mi.	Rock Bridge State Park	Boone
East Fork Black River	3 mi.	Johnson's Shut-Ins State Park	Reynolds
First Nicholson Creek (East Drywood Creek)	2 mi	Prairie State Park	Barton
Gans Creek	3 mi.	Rock Bridge State Park	Boone
Huzzah Creek	6 mi.	Mouth to Hwy 8.	Crawford
Indian Creek	17.5 mi.	Mark Twain National Forest	Douglas-Howell
Ketchum Hollow	1.5 mi.	Roaring River State Park	Barry
Little Piney Creek	25 mi.	Mouth to 21,35N,08W	Phelps

Waterbody	Miles/Acres	Location	County(ies)
Little Black River	3 mi.	Mud Puppy Natural History Area S22,T24N,R3E to S25,T24N,R3E	Ripley
Log Creek	0.4 mi.	Bonanza Conservation Area	Caldwell
Meramec River	8 mi.	Adjacent to Meramac State Park	Crawford-Franklin
Meramec River	3 mi.	Adjacent to Onondaga and Huzzah State Forest	Crawford
Mill Creek	5 mi.	Mark Twain National Forest	Phelps
N. Fk. White River	5.5 mi.	Mark Twain National Forest	Ozark
Noblett Creek	5 mi.	Above Noblett Lake, Mark Twain National Forest	Douglas-Howell
Onondaga Cave Branch	0.6 mi.	Onondaga Cave State Park	Crawford
Pickle Creek	3 mi.	Hawn State Park	Ste. Genevieve
S. Prong L. Black River	2 mi.	In Little Black Conservation Area	Ripley
Shoal Creek	0.5 mi.	Bonanza Conservation Area	Caldwell
Spring Creek	17 mi.	Mark Twain National Forest	Douglas
Spring Creek	6.5 mi	Mark Twain National Forest	Phelps
Taum Sauk Creek	5.5 mi.	Johnson's Shut-Ins State Park Addition S23,T33N,R2E to S5,T33N,R3E	Reynolds-Iron
Turkey Creek	4.6 mi.	In Three Creeks Conservation Area	Boone
Van Meter Marsh	80 ac.	Van Meter State Park	Saline
Whetstone Creek	5.1 mi.	Whetstone Creek Conservation Area	Callaway

***Source for all Tables in this appendix is 10 CSR 20-7.031, Water Quality Standards**

APPENDIX H

Waterbodies with Water Quality Problems Not Quite Severe Enough to be Placed on the 303(d) List

Waterbodies with Water Quality Problems not Quite Severe Enough to be Placed on 303(d) List

1. Waterbodies designated as drinking water supply sources with long term average atrazine raw and or finished water atrazine concentrations above 2.00 ug/l or cyanazine concentrations above 0.75 ug/l.

Schuyler Co. PWSD#1 Res.	Atrazine	Corn, sorghum production
Unionville Reservoirs	Atrazine	Corn, sorghum production
Monroe City South Res.	Atrazine	Corn, sorghum production
Lake Thunderhead	Atrazine	Corn, sorghum production
Marceline Reservoirs	Atrazine	Corn, sorghum production
Edina Reservoir	Atrazine, Cyanazine	Corn, sorghum production
Pape Res. (Concordia)	Atrazine	Corn, sorghum production
Breckenridge Reservoir	Atrazine	Corn, sorghum production
Adrian Reservoir	Cyanazine	Corn, sorghum production
Sugar Creek Res.(Moberly)	Atrazine	Corn, sorghum production

2. Waterbodies designated as drinking water supply sources which have long term average summer Chlorophyll-a concentrations above 40 ug/l. We consider these reservoirs to be at the greatest risk for chronic taste and odor problems in finished drinking water.

   Marceline Reservoirs
   Maysville Reservoirs

Note: Two other general categories of waterbodies might be considered for this list as a method of giving them the high priority they deserve: 1) streams draining areas with large confined animal populations, particularly if there is instream evidence of impact such as elevated concentrations of nitrate, 2) streams subjected to substantial physical alteration due to urbanization or other land use change.

*Source: John Ford, DNR-WPCP

APPENDIX I

Watershed Implementation

WATERSHED IMPLEMENTATION

Introduction
The term *watershed* refers to a geographic area in which water, sediments, and dissolved materials drain to a common outlet. This area is also called the drainage basin of the receiving waterbody. However, when working on an area for the protection of water quality, local decisions on the scale of geographic unit consider many factors, including the ecological structure of the basin, the hydrologic factors of underlying ground waters, the economic uses, the type and scope of pollution problems, and the level of resources available for protection and restoration projects. The waterbody/watershed is a functioning unit with interacting biological, physical, chemical and human components. If a waterbody suffers from problems often the cause of the problem can be linked to a source or sources within the watershed. In order for a water quality project to be successful it must take into account all factors of the watershed: local support, land use and potential for success.

Development and implementation of a consistent, coordinated and integrated process to guide watershed-based resource planning and management to protect, enhance and restore the state's watershed ecosystems to the benefit of all Missourians is the goal. The process involves local, state, federal and private land and water managers and interested citizens. A detailed discussion of watershed implementation assistance programs can be found in Appendix J.

Completed Watershed-Based Implementation Projects

Mark Twain Watershed Project
Management of the project is being directed out of the Macon Water Quality Project Office and by the Natural Resources Conservation Service (NRCS) State Office. Technical specialists from the NRCS State Office, the University of Missouri Columbia (UMC), Extension Service (ES), Missouri Department of Natural Resources (DNR) and Missouri Department of Conservation (MDC) are also available to provide technical expertise. The project funds are supporting technical assistance personnel above the customary staffing level and water quality monitoring.

The Mark Twain project is located in northeast Missouri. The area, approximately 630 square miles (404,800 acres), includes all of the drainage area of the Crooked, Otter and North Fork tributaries located within the hydrologic or political boundaries of Knox, Monroe and Shelby counties that empty into Mark Twain Lake. Upland and bottomlands of the basin are intensively cropped. Agricultural land comprises 55 percent of the project area's land use and is the number one industry in the basin. Soybeans, corn, wheat and other feed grains and forage crops are the major crops grown in the basin, and agricultural chemicals and pesticides are used extensively throughout the area.

The basin is also a major hog producing region, with Shelby and Monroe Counties in the top ten of hog producing counties in Missouri. More than 300 swine facilities are in operation with an additional 100 dairy and beef operations in existence. Animal waste produced has a human population equivalent of 144,500.

Soil erosion and rainfall runoff are the major hazards on about 80% of the cropland and pasture in the project area. Sediments are a problem, in that, they carry nutrients and chemicals attached to the clay/silt fractions that are deposited in the lakes and stream courses of the project area.

Project goals are to demonstrate and evaluate the effectiveness of total resource management plans (TRMPs) in addressing the resource problems within the area and provide technical assistance for the installation of animal waste systems. Plans utilizing an interdisciplinary team are being developed and installed to assist in reducing the quantities of sediment and chemical pollutants (nutrients and pesticides) entering the water body system and being deposited in public drinking water supply reservoirs within the project area and to Mark Twain Lake at the mouth of the project area. Another major goal is to finalize the training of 16 NRCS field personnel in the formulation and implementation of nutrient/pesticides strategies, as part of the TRMP process. Three areas of training needed by NRCS personnel include crop/nutrient, soil fertility, and integrated pest management. The training is being accomplished utilizing existing Extension In-service Education (ISE) programs, Certified Crop Advisory (CCA) classes, and Integrated Crop Management (ICM) course curriculum. This will give NRCS the base of expertise necessary to provide additional training to field personnel throughout the state for future planning activities.

Evaluation of project activities is accomplished by periodic meetings of the training advisory committee, and local, state, and private industry participants. Educational/informational needs, cooperator recruitment, and the monitoring program are reviewed, evaluated, and revisions made as necessary. A quarterly progress report, as a minimum, to DNR summarizes project progress of revisions necessary to meet project objectives.

Project Period:	January 1, 1993—December 31, 1997	
Sponsor:	USDA-Natural Resources Conservation Service	
Funding:	EPA/DNR	$585,200
	Nonfederal match	$478,800
Contact:	The Mark Twain Water Quality Initiative 28898 US Highway 63 Macon, MO 63552-9587 Telephone: (816) 385-6359	

Upper Shoal Creek Watershed
Poultry Litter/Nutrient Management Demonstration
The Poultry Litter/Nutrient Management Demonstration Project supports technical assistance for the Southwest Missouri Resource Conservation and Development, Inc. (RC&D) office to

provide a nutrient management specialist in the Upper Shoal Creek watershed. The specialist is employed by the Southwest Missouri RC&D and is stationed in the Barry County Soil and Water Conservation District (SWCD) in Cassville, MO.

Further down in its watershed, Shoal Creek supplies drinking water for 10,000 people in Neosho and 45,000 in Joplin.

The 59,400-acre Upper Shoal Creek watershed is located in Barry and Newton Counties in southwest Missouri. Land use in the watershed is estimated to be 73 percent grassland, 20 percent forest land, 5 percent other (water, roads, farmsteads) and 2 percent cropland. Many poultry companies have facilities in this watershed. Annual poultry production in southwest Missouri is at about 190 million broilers and 20 million turkeys. This production generates approximately 465,000 tons of litter per year. Broiler production is increasing annually.

Excessive nutrients are potential problems to the tributaries, springs and groundwater resources of southwest Missouri and its downstream neighbors. Present nutrient sources in the Upper Shoal Creek watershed include municipal wastes, livestock and poultry wastes and fertilization. Water quality data for the nearby Elk River shows increasing levels of nitrogen and bacteria in streams over time, believed to be due primarily by land application of animal wastes. Monitoring of water quality in Shoal Creek suggests it is also affected by land application of animal waste, but the amount of monitoring done to date is insufficient to document any time trends.

Protection of the drinking water supply by controlling (karst terrain) groundwater infiltration and surface runoff to reduce nutrient delivery and control soil erosion are the two major issues to be addressed in the management of poultry production lands draining into Upper Shoal Creek. Consideration is also given to the federally threatened, state-endangered Ozark Cavefish, the state-endangered Little Purple Mussel and a variety of other animals and plants on the state-listed watch list in this watershed.

Sponsor objectives are: (1) to provide direct technical assistance to producers in the project area to plan and implement nutrient management plans for reducing and controlling nutrients (promoting appropriate poultry litter land application rates) in the project area; (2) to monitor nutrients (N, P, K) in soils, streams, springs, ponds and wells at selected demonstration sites; (3) to monitor land use in relationship to long-term management practices; 4) to use results of the project to evaluate guidelines for poultry litter nutrient applications; and 5) to reduce and control nutrient concentrations leaving the fields in surface runoff or by leaching to the groundwater resource.

Project Period:	1995—2000	
Sponsor:	Southwest Missouri RC&D Council, Inc.	
Funding:	EPA/DNR	$378,700
	Nonfederal match	$309,845

Contact: Rita Mueller
Southwest Missouri RC&D Council, Inc./Barry Co. SWCD
283 US Hwy 60 W
Republic, MO 65738
(417) 732-6485

Loose Creek Water Quality Initiative Project

The Loose Creek Water Quality Initiative Project supports technical assistance, animal waste handling equipment and construction for the Osage County Soil and Water Conservation District (SWCD) to demonstrate, develop, and implement sound nutrient management practices in the watershed.

The Loose Creek watershed consists of approximately 45,000 acres (12% of county acreage), 19,200 acres of woodlands, 16,700 acres of pasture and hay ground, 5,900 acres of row crops and small grains, and 3,200 acres in cities, communities and home lots. The 248 farms in the watershed consist of 25 poultry producers (1,000,000 one-time capacity), 35 swine producers (40,000 head), 2 dairy operations (200 head) and 112 beef farms (5,600 head). Over the past two decades, confinement livestock production has increased significantly in Osage County. Swine and poultry producers have also intensified their production. In 1975, 500 plus farmers produced 48,500 head of swine while in 1991 slightly less than 300 farmers produced 92,600 head. Poultry production has intensified much the same way. In 1987, 43 turkey producers had a one-time capacity of 585,000 birds; now 25 producers have a one-time capacity of 1,000,000 birds. These operations produce approximately 45% of the swine and 75% of the poultry produced in the county. A relatively small percentage of the county's acreage is used to produce a large percentage of the swine and poultry. This situation concentrates animal wastes in a small segment of the county.

Animal waste management is a major resource concern in the Loose Creek watershed. More animal waste is generated on farms in the watershed than can be land applied under approved management plans utilizing current practices and technology. Topography, gently sloping to steep (2 - 35% slope), causes additional concern as the majority of the land available for a soil plant filter is greater than 10% slope, which has limited use for land application under current regulations. Currently, only two swine operations in the watershed have an approved animal waste management system.

The overall objective of the project is to improve water quality through adoption by producers of sound nutrient management practices. This will be achieved primarily through the proper handling and usage of waste generated by poultry, swine, dairy and beef operations. The project coordinator will be the pivot point of all activities tied to this project. Assistance from other agencies includes: (1) University of Missouri Extension, livestock specialist that will provide expertise in livestock management; (2) An Extension ag engineer that will provide assistance with system analysis, farmstead planning and land application of animal/poultry waste; (3) The Natural Resources Conservation Service (NRCS) will do the technical design of animal waste facilities; (4) An Extension farm management specialist will provide assistance to participating producers with economic analysis of proposed changes/systems prior to detailed design and construction; (5) An NRCS nutrient management specialist will work with a regional Extension

agronomy specialist in advising producers on cropping systems related to animal waste and nutrient management; (6) A local field technician will provide the necessary surveys and on-site work in support of the project. The NRCS engineer will work closely with the Extension engineer in the overall planning of facilities and provide the technical designs for proposed animal waste management facilities as required by the DNR for construction and acquisition of the necessary Letters of Approval.

Project Period:	August 1, 1995—May 31, 2000	
Sponsor:	Osage County Soil and Water Conservation District	
Funding:	EPA/DNR	$492,050
	Nonfederal match	$402,500
Contact:	Osage County Soil and Water Conservation District P. O. Box 588 Linn, MO 65051 Telephone: (573) 897-3797	

Fellows/McDaniel Lakes Watershed

This project focuses on the City of Springfield's two water supply reservoirs on the Little Sac River: McDaniel and Fellows Lakes. McDaniel Lake, completed in 1929, stored 1.46 billion gallons of water. Fellows Lake (1955), 3 miles upstream, stores 10.1 billion gallons. The combined watersheds of these reservoirs are about 39 square miles, (25,000 acres).

Both reservoirs have experienced nutrient inputs of concern to water supply personnel. Studies of the lakes over a five year period, 1983-1987 indicated that McDaniel Lake was moderately eutrophic and Fellows Lake was at the upper end of mesotrophic. A watershed study started in 1983 as a response to severe taste and odor problems in the water supply. These problems were related to algae blooms believed to have been stimulated by excessive nutrient input from the watersheds. Agriculture was then the predominant land use in the watershed.

This watershed project utilizes a comprehensive approach to watershed management aimed at preventing further water quality degradation of these important drinking water sources. The two categories of nonpoint source pollution believed to constitute the greatest water quality threats at this time are addressed - runoff from agricultural activities, primarily cattle operations; and septic tank leachate from systems in marginal sites and soils.

The outreach plan contains a video/slide presentation to document the monitoring, best management practices (BMPs) implementation and results from the agricultural runoff demonstration project. Also included are fact sheets on the BMPs. A practical guide to performing site evaluations for local inspectors, engineers, soil scientists and other persons who have a stake in the successful performance of on-site sewage systems is under development as well as video tapes/slide shows /brochures and technical sheets to be used as training tools on job site evaluations. A special plan has been developed for monitoring on-site wastewater systems in karst terrain.

While this project agreement has very recently culminated, the demonstration, education and monitoring efforts will be on-going. A summary follows. During the early years of the project a clean lakes study was also taking place on McDaniel Lake. Over the sampling period of the study the lake water quality showed improvement.
Project Period:1992—1998

Sponsor: Watershed Committee of the Ozarks

Funding:	EPA/DNR	$63,000
	Nonfederal match	$56,000

Contact: Loring Bullard
Watershed Committee of the Ozarks
320 N. Main
Springfield, Missouri 65806
(417) 866-1127

Project Summary
A study was implemented between 1982-1988 by City Utilities of Springfield. This study was prompted by taste and odor problems and subsequent public concern; the result of decaying algal blooms. Phosphorus, because of its role in algae production, was the main nutrient of study. The tributaries that exhibited the highest concentrations of phosphorus were those associated with dairy operations that had overgrazed slopes - the biggest contributor being a tributary (referred to as R-16) to the Little Sac River. R-16 has been extensively monitored ever since.

The steering committee for this project began in 1992. The committee consisted of representatives from City Utilities of Springfield, NRCS, Agricultural and Stabilizations & Conservation Service, University of Missouri-Extensions, Greene County Soil & Water Conservation District, Missouri Department of Conservation, Watershed Committee of the Ozarks and local landowners based throughout the watershed. As a result, the Watershed Committee of the Ozarks was able to contract with local cooperators for a cost-share effort to implement best management practices.

There were five demonstration and monitoring sites. 1) Gary Lewis Farm, 2) Eddie Smith Bar S Ranch, 3) City Utilities of Springfield Demonstration Farm, 4) Hugh Brewer Low-Pressure Pipe Site, and 5) Crystal Cave Spring.

<u>1) Gary Lewis Farm Demo</u>

Solar powered pump system and shallow alluvial well, fresh water stock tanks at the elevated pasture level, riparian fencing 100' from spring and a dairy waste collection and management system were added to this 65 dairy cow operation. Solids and liquids were separated in the management system, and solids were removed to spread on pasture for fertilization. It was noted that frequency of solids removal is necessary for optimum liquid separation to occur. Due to sediment accumulation in the pump filters and geology constraints, pipes to the solar powered

pump system were later diverted to an existing well and the solar panels and pump were relocated to a different project.

Before Prior to this demonstration, dairy cows had direct access to the spring. Devegetation was evident in the spring area and animal waste was deposited directly into the spring where dairy cattle were contaminating their own drinking source and nutrients were ultimately making their way to the Little Sac River. The cows tended to stay in the cooler area and would not graze as is desired for optimum weight gain. Many calves were observed in poor condition with fatalities being noted. This operation was suffering economically.

After Economic viability of the dairy operation was rediscovered and nutrient and sediment loading to the R-16 tributary and ultimately the Little Sac River was reduced. No calf fatalities have been observed at this operation since the implementation of best management practices. Cattle have grazed more, animal waste has been more evenly distributed across the pasture and the cows' water supply is cleaner. The added best management practices are now part of daily operations.

2) Eddie Smith Bar S Ranch Demonstration

This site is located in the upper end of the R-16 tributary, west of the Gary Lewis farm. This is a cow/calf operation with a few horses. The herd would water in the drainage area where a small spring exists. Denuded slopes and erosion were prevalent. Cost-share assistance was made available to this operation for watering site relocation and riparian revegetation. This spring was retrofitted to pump water to a higher location, using electricity from residential power lines. The central water system was strategically located on this elevated area to allow access from different pastures. The riparian corridor was also fenced to allow revegetated growth to serve as a buffer.

Maintenance and management for this site has been minimal as compared to the Gary Lewis Farm Demo. These practices demonstrate cost-effective, low-maintenance ways to protect water quality while potentially enhancing the economic value of an agricultural operation.

3) City Utilities of Springfield Farm Demo

The City Utilities of Springfield Demonstration Farm is located at the confluence of the R-18 tributary and the Little Sac River. Best management practices implemented at this site include riparian corridor establishment, solar water system, solar fencing system and pasture enhancement with management intensive grazing.

Before Riparian areas along the streambanks of the R-18 and the Little Sac River exhibited eroded and incised banks. Algal mat potential was evident. Land was leased to local residents for hay production.

After Dramatic improvement is evident five years after re-establishment of the riparian corridor. Activities included fencing, sycamore planting and willow-staking in bank areas, multiple species tree planting in upper riparian area and coconut-fiber biolog

implanting in a particularly eroded tributary bank. Diverse species of birds and fish that have never been observed at this site are now present. Aesthetics and habitat have improved considerably.

Solar panels power a water pump 50 yards away, and water is supplied to four stock tanks. Lessons learned from the Gary Lewis farm demo resulted in adequate an adequate chert and gravel alluvium, thereby preventing sedimentation problems in the filters. The only problem encountered was pump damage due to frozen pipelines. Burying the water lines deeper or shutting off the pump in severely cold weather would have prevented this breakdown. Another solar panel was installed for charging the electric fence. On one occasion, bird droppings contributed to reduced generation capacity. Panels are inspected more frequently to avoid this problem.

A management intensive grazing system was developed. Demonstration was provided for different methods of incorporating warm and cool season grasses into divided paddocks (pasture cells). Outstanding growth is evident and these pastures are now being grazed by a twenty-head herd of beef cattle supervised by the Southwest Missouri State University Agronomy Department. A small herd of horses is being grazed in other paddocks as well.

Analysis of the R-16 Tributary

The R-16 tributary has historically exhibited elevated levels of phosphorus. The Gary Lewis Farm and the Eddie Smith Bar S Ranch are located at the headwaters of the R-16 tributary and have been implicated as potential sources of phosphorous loading. Over sixteen years of monitoring from 1983 to 198, trends in phosphorous levels have generally decreased. Though decreasing trends may be interpreted in part to the practices implemented in this program, it should be noted many external factors such as temperature, sol radiation, rainfall intensity and frequent, and her size could impact trends as well. A qualified analysis of trends is available upon request.

Education and Demonstration Awareness

Numerous field trips have been conducted at these demonstration sites by many organizations and agencies and will continue in the future. The audience has included the agricultural community, teachers, college students and resource managers. Signs are posted to inform local residents of the implemented cooperative efforts.

4 & 5) On-site Wastewater Demonstration at the Hugh Brewer Residence and Ed Mills Residence

Cost-share assistance was provided to the landowners for the construction of their systems only for costs above the price of a "standard" conventional system. The Watershed Committee of the Ozarks monitored performance of the systems.

A low-pressure pipe septic system was installed at the Hugh Brewer residential site. This was chosen as a reasonable alternative to the conventional septic tank systems unsuitable in Greene County due to geographical constraints. This system incorporates an intermittent dosing cycle that enhances treatment of the effluent by allowing the soil to rest between cycles. An alarm is in place to alert the homeowner if the pump fails. If the homeowner understands the system and provides adequate maintenance, the pump should not fail.

A shallow-trench conventional system was installed at the Ed Mills residence. This consisted of a conventional system with shallow lateral lines buried at a minimum of 18 inches due to a restrictive layer of clay. No problems were observed with the maintenance of this system and surfacing wastewater has not been detected even though the lateral lines are quite shallow.

Analysis of On-Site Wastewater System Demos

The Hugh Brewer low-pressure pipe system adequately treated its waste. Some months were too dry to collect samples. Monitoring and analyses will continue. Analysis at the Ed Mills site could not be completed due in part to lack of soil moisture conditions and a prolonged delay in the construction of the residence. Monitoring and analyses will resume in the future.

Other Project Elements

The Watershed Committee of the Ozarks also participated in a spring sampling plan (affiliated with other studies) in the Fellow-McDaniel Lakes watershed. Twelve springs were sampled for a variety of analytical parameters. The purpose of this program was to form a database on the shallow groundwater system and analyze land use impacts upon it. The results of this study suggest some springs may be under the influence of wastewater contamination.

In addition to the numerous field trips to the demonstration sites described above, the Watershed Committee of the Ozarks completed home sewage surveys, developed brochures, published articles and sponsored and participated in numerous public events highlighting the elements of this project. Detailed information and formal studies affiliated with this project can be obtained by contacting the Watershed Committee of the Ozarks in Springfield, Missouri, at (417) 866-1127.

Osage Fork of the Gasconade River Watershed

The Osage Fork Livestock Waste Management Project supports technical assistance for the Laclede County Soil and Water Conservation District (SWCD) to provide a Resource Management Specialist and a Pumping Technician in the watershed. The specialist and technician are employed by the Laclede County SWCD and are stationed in the Lebanon, Missouri office.

Common uses for the streams within the Osage Fork watershed include year-round recreational

fishing, boating, swimming, and livestock and wildlife watering. The Gasconade River and nearby aquifers are used as a public drinking water supply by approximately 70,000 residents. Approximately 48,000 of those residents drink groundwater derived from bedrock aquifers, many of which are vulnerable to contamination due to their karst topography nature.

The 325,000 acre watershed contains approximately 250 dairies (totaling an estimated 36,000 dairy cows) and 36,000 head of beef cattle with 7% cropland, 33% forest, 50% pastureland, 7% urban/farmstead roads, 1% water and 2% public ownership.

Many acres of the pastureland are currently overgrazed, producing sediment runoff and resulting in deterioration of water quality and soil conditions. Excessive sediment runoff decreases the moisture available to plants for development, increases the sediment load, increases the contamination of surface water sources and decreases the holding capacity of surface water sources. This condition, when coupled with the karst nature of the Ozark region, makes the area highly vulnerable to surface and groundwater contamination. The Osage Fork watershed is home to the Bluestripe and Least Darters, among several other species, which are listed as either Rare, Endangered or on a Watch List.

Sponsor objectives are: (1) to provide technical assistance (through outreach and demonstration) to area producers in planning for and implementing best management practices to reduce groundwater and surface water contamination; 2) to routinely monitor nutrients (N,P,K) and other nutrient levels in soils at designated waste application sites; 3) to routinely monitor nitrogen, dissolved oxygen and macroinvertebrates in area streams and springs at or near selected demonstrations sites; 4) to develop guidance materials recommending acceptable effluent application rates for nitrogen and phosphorus and related acceptable best management practices; 5) to survey landowners before and after demonstrations to determine effectiveness of project; 6) to monitor land use and how it will affect long-term management practices; and 7) to reduce and control nutrient concentrations leaving the fields in surface runoff or by leaching to the groundwater resource.

Project Period:	1996—2001	
Sponsor:	Laclede County SWCD	
Funding:	EPA/DNR	$464,760
	Nonfederal match	$380,259
Contact:	Laclede County SWCD Joyce Johnson Route 6, Box 373C PO Box 1015 Lebanon, MO 65536 (417) 532-6305	

Miami Creek/Drexel Reservoir Watershed
The project encompasses approximately 80,000 acres of land within Bates County, Missouri.

The watershed is made up of three hydrological units within the Upper Osage/ Marais des Cygnes River Basin. Included within this project area is the Butler Municipal Reservoir, the city's intake located on Miami Creek, and the Drexel water supply reservoir. Together, these supply drinking water to the cities of Butler, Drexel, Amsterdam and five public rural drinking water districts. These reservoirs are also used for recreational activities such as fishing. With the encroachment from the Kansas City Metropolitan area increasing, so is the demand for safe usable water in the area.

Results from water monitoring completed by the cities and the Department of Natural Resources have detected high levels of the herbicide atrazine in their water supplies. Atrazine is not the only concern in the project area; nitrogen, phosphorus, bacteria, and sediment are other major water quality concerns. Possible sources of contaminants in the watershed include several livestock facilities located in or adjacent to the Miami Creek flood plain and cropland primarily used in conjunction with a corn-soybean-small grain cropping rotation. This rotation typically involves application of atrazine in one out of three years.

The overall goal of the Miami Creek/Drexel Reservoir Protection and Restoration Demonstration Project is to improve and protect the quality of water throughout the watershed. The Miami Creek/ Drexel Reservoir provides water to approximately 8,500 residents, with this figure growing every day. Protecting the water quality in these two watersheds will be accomplished by achieving the following objectives: inform, educate and demonstrate controlling chemical runoff, animal waste runoff and sheet and rill erosion by implementing best management practices. It is hoped that greater than 95 percent of the land users can be educated about the proper techniques in protecting the water quality in the Miami Creek/Drexel Reservoir watershed.

Project Period:	1996—2001	
Sponsor:	Osage Valley RC&D	
Funding:	EPA/DNR	$507,712
	Nonfederal match	$415,401
Contact:	Osage Valley RC&D Stephen Wilson 100 Wesmor, Suite 2 Clinton, Missouri 64735 (816) 885-5052	

James River/Table Rock Lake Watershed Partnership

Table Rock Lake was created in Southwest Missouri in the late 1950s. It is a popular recreational lake, drawing millions of visitors a year. The waters in this region have been historically known as high quality resources. Fishing for bass, crappie, and other game fish, boating swimming, scuba diving, and other fresh water activities have been vital components to the area's economy. There have also been plans proposed recently to use Table Rock Lake as a drinking water source for the ever growing community of Branson. The growth of the area is

phenomenal and is continuing. Branson, although not in the James River Basin, relies on the quality of the area's lakes for its economic viability. Branson housed over 6,000,000 visitors in 1994. It is expected that this number will increase to over 10,000,000 by the year 2000. The James River is a major tributary to Table Rock Lake and has portions of the city of Springfield within its watershed.

Water quality monitoring results from recent years show trends of higher total phosphorus, total nitrogen, and chlorophyll levels and lower Secchi disk readings in Table Rock Lake near the dam. One of the main purposes of the study is to discover the sources of nutrient enrichment in the lake. Increased loading of nutrients and sediments from recent development and from animal agriculture in the watershed have promoted algal growth and decreased water clarity. Nutrient rich wastewater additions come to Table Rock Lake from Springfield to the James River Arm of the lake and from numerous small treatment facilities as well as from nonpoint sources in the watershed.

A watershed partnership is designed to use the Table Rock Lake study and the coordination of all of its members to produce a whole-basin watershed management plan. It is important and appropriate to study the lake and watershed at this time to determine the causes of the decline. This will give us solid facts to use in a complete watershed strategy.

Project objectives include forming a James River Watershed Partnership composed of people who live work, and play in the James River Basin and will be designed to protect that watershed. The partnership coordinates with the University of Missouri's Table Rock Lake Water Quality Study to determine more about the apparent decrease in water quality. The final output from this watershed partnership will be the development of a whole watershed plan.

Project Period:	1996—2000	
Sponsor:	Southwest Missouri RC&D	
Funding:	EPA/DNR	$147,914
	Nonfederal support	$ 57,252
Contact:	Southwest Missouri RC&D Rita Mueller/Diana Sheridan Plaza Southwest Center 283 US Hwy 60 W Republic, Missouri 65738	

Public Water Supply Watershed Management Education

Six public drinking water reservoirs in western Missouri were identified in 1994 as having atrazine levels exceeding the maximum contaminant level (MCL) of 3 ppb established by the Environmental Protection Agency (EPA). These lakes are located in Adrian, Dearborn, Drexel, Hamilton, Higginsville and Jamesport. The watersheds surrounding these lakes are primarily used for agricultural production. It is our intention to form a community based watershed alliance for each of the six reservoirs to ensure long-term management and compliance.

A project coordinator will work with the six identified communities for a three one-half year period. The project coordinator will provide overall leadership and assist local Extension faculty with developing management strategies for area landowners and agricultural producers and help establish watershed alliances within the communities, and develop a watershed based approach to insure water quality.

Selected Extension specialists working and living in the communities will constitute a working group that will implement an education program and develop a community watershed alliance. The education program will teach local citizens and officials how to develop strategies to protect their public water supply and enhance community involvement.

Project products will include: 1) examples of watershed management plans that can be used in other areas of the state; 2) local citizens groups established to monitor and ensure water quality standards of public drinking water supplies; and 3) best management practices implemented in the watershed for the reduction of atrazine plus other agricultural runoff.

Project Period:	1995—1999	
Sponsor:	University of Missouri - Columbia, Extension	
Funding:	EPA/DNR	$306,757
	Nonfederal match	$250,930
Contact:	University of Missouri - Columbia University Extension 205 Agricultural Engineering Columbia, Missouri 65211 (573) 882-0085	

Niangua Basin Planned Grazing Demonstration

The Southwest Missouri Resource Conservation and Development Council (SWMO RC&D), Inc. received NPS funds to provide annual incentive payments to producers for implementing and demonstrating managed grazing systems that protect ground cover, reduce quantity and improve quality of runoff water, and provide more efficient forage production. The funds are also supporting soil testing and informational activities.

The project area includes about 236,000 acres and contains intensive dairy and beef operations with emphasis on forage production, either for hay or pasture. The watershed is a karst area that includes sinkholes, losing streams, caves, and permeable soils. These areas are extremely vulnerable to contamination by allowing surface runoff to enter deep ground water or the Niangua River. The watershed area is also a major recreation area providing canoeing, fishing, and other outdoor activities. Bennett Springs State Park (a major trout fishing area) is also located in the project area. The final destination of the Niangua River is the Lake of the Ozarks.

Objectives of this project are 1) to demonstrate best management practices for pasture

management and utilization of animal waste to prevent nonpoint source pollution 2) to inform local and regional landowners of the economic and ecological benefits of proper pasture management and 3) to demonstrate riparian corridor protection as a part of the total farm system.

Grazing practices demonstrated:

Rest-rotation grazing: Multiple pastures (paddocks) leaving one or more idle each year.

Deferred rotation: Discontinued grazing on different parts, allows each grazed part (pasture/paddock) to rest a growing season.

Twice-over rotation: Rotates animals faster allowing for a long period of rest between rotations.

Start-duration: Rotation using multiple pastures/ paddocks. Involves large herd, many small parts, and high stocking density.

Six livestock/dairy operations were selected to participate as model sites to demonstrate the effectiveness of grazing best management practices. Systems installed are being customized to each producer. Incentive payments are being provided for participation. Implementation of a total resource management system is required of each participating producer.

Demonstration farms will participate in two to three annual tours jointly sponsored by University Extension, the Natural Resources Conservation Service and the SWMORC&D. A series of workshops will be held each year to provide training to landowners and agency personnel working in the region. Participants will become more knowledgeable in (1) plant growth, (2) plant management, (3) soil fertility, (4) species selection, (5) livestock needs, (6) water development, and other aspects of a controlled grazing system necessary to derive economic and environmental benefits of participation.

Site level monitoring will be conducted and will include annual soil sample collections of the individual paddocks within the grazing system to be tested for nutrients (nitrogen, phosphorus and potassium). Monitoring will provide necessary parameters for on-farm evaluation of intensive grazing systems.

MDC will develop four stream wildlife riparian management areas. The Missouri Department of Conservation will cost-share to install wildlife areas that will include tree and shrub plantings, livestock exclusion, natural vegetation, tree revetments, riffle structures, rip-rap and anchored root wads.

Project period:	March 1, 1994—December 31, 1999	
Sponsor:	Southwest Missouri Resource Conservation and Development	
Funding:	EPA/DNR	$101,000
	Nonfederal match	$ 82,636

Contact: Southwest Missouri Resource Conservation and Development
Plaza Southwest Center
283 US Hwy 60 W
Republic, MO 65738
Telephone: (417) 732-6485

Fulbright Spring Urban Recharge Area Watershed

Fulbright Spring has been in use as a public drinking water source by the city of Springfield since the 1880s and continues to supply about twenty percent of the source water on an annual basis. The approximate recharge area, roughly defined in the 1970s, was further refined through a 1990 EPA-funded wellhead protection monitoring system study. About one-third of the 23,000 acre inferred recharge area is within the city of Springfield the remainder in the unincorporated area of Greene County. A substantial portion of the spring's flow is derived from losses of surface streamflow in the upper South Dry Sac basin. Sinkholes in the basin have also been shown to contribute flow. City Utilities routinely monitors the spring for a host of Safe Drinking Water Act contaminants. Data indicate that the water quality of the spring remains relatively high in spite of occasional spikes of some parameters such as turbidity and fecal coliform, during storm events. This is not surprising given the open nature of this karst hydrologic system, with its high degree of surface - groundwater interaction.

Fulbright Spring is probably the most easily compromised of any of the city's raw water sources. The largest concern from a water treatment standpoint is organic chemical contamination such as biocides, hydrocarbons and solvents. The use of such materials in the spring recharge area is expected to increase with expanding urbanization. Without a protection program in place as urbanization proceeds, the spring will likely degrade to the point of requiring sophisticated and expensive water treatment processes or abandonment as a source. This project is designed to prevent that possibility.

The three major components of the project are: watershed and spring monitoring, best management practice implementation and monitoring, public education and public involvement.

Project Period: 1996—2000

Sponsor: Watershed Committee of the Ozarks

Funding:		
	EPA/DNR	$100,000
	Nonfederal match	$ 90,000

Contact: Watershed Committee of the Ozarks
Adam Coulter
320 N. Main
Springfield, Missouri 65806
(417) 866-1127

Turkey Creek Watershed Protection Project

The Turkey Creek watershed project area encompasses 61,000 total acres with the majority of the project area, approximately 57,750 acres, being in Carroll County, while approximately 3,250 acres is located in Ray County. There is no urban land located within the drainage area. Land uses in the project area includes an estimated 60 percent in row crop production; 30 percent in grassland including Conservation Reserve Program (CRP) land; and the remaining 10 percent is devoted to other uses such as roads, farmsteads, and livestock facilities. There are approximately 310 landowners located in the project area, which is all agricultural. Row crop farming is the primary land use for the area, but there are several fairly large livestock confinement units for hogs, beef cattle, and dairy cows. While none are large enough to require a permit, eleven are registered with the DNR as Class II operations. Most of these operations have a small lagoon and apply waste products by spreading the material over fields near the waste storage structure. Timing of the present applications is not always the best for water quality.

Excessive chemicals, nutrients, and animal wastes are problems identified by the Department of Natural Resources in the watershed. Landowner contacts resulted in the same concerns being identified, and the producers are searching for solutions both to take care of the environment and to stay in compliance with all governmental regulations. The objectives identified by landowners were to improve waste treatment and handling for each livestock operation, to reduce the amounts of pesticides and fertilizers applied to cropland, to further reduce the level of soil erosion and sedimentation, and to treat 75 percent of CRP ground released with no-till farming, rather than conventional tillage. Grant funds will not be used as incentive payments to support no-till farming.

Producers in the Turkey Creek watershed will be asked to develop Total Resource Management (TRM) plans which include BMPs for livestock waste management, the proper use and application of pesticides and fertilizers, and the installation of erosion control practices to reduce sedimentation. Cost-share incentives will be available to those producers who develop and implement plans to improve water quality. Integrated crop management specialists from the private sector, the Natural Resources Conservation Service (NRCS), and the University Extension Service will be available to advise operators on the proper use and application of pesticides, animal waste and fertilizer. An incentive will be offered to those producers who use this service to properly apply correct amounts, which should reduce the runoff of improperly applied or over applied chemicals. Funding to install these practices will come from the AGNPS SALT Cost-Share Program administered by DNR's Soil and Water Conservation Program and from the Federal Environmental Quality Incentives Program.

There has been no water quality sampling in the past that the District is aware of, but the Stream Team from Norborne High School has agreed to sample water at two locations recommended by WPCP staff which include one site on Turkey Creek upstream of the confluence of Wakenda Creek and one site on East Fork Wakenda Creek near the confluence of Wakenda Creek. The Stream Team will monitor water temperature, pH, conductivity, nitrate-N, ammonia-N, phosphorus, dissolved oxygen and macroinvertebrates.

The Turkey Creek Watershed Protection Project has the goal of informing and educating 95 percent of the land users within the project area. To accomplish this goal, an ambitious information and education program has been scheduled. Eleven workshops targeting producers from all the major land use areas will be scheduled. Six field days at good demonstration sites will be selected and toured during the project, which will include a waste management demonstration and a streambank stabilization site.

Fact sheets relating to BMPs and ICM will be developed and published in a joint effort of the SWCD, NRCS and University Extension. A landowner survey of land users' knowledge of BMPs will be taken at the start of the project and again at the end to measure results of the educational efforts. Success stories from the use of BMPs and ICM will be compiled and published to share with operators in the project area. A newsletter will be published by the District twice per year during the life of the project and will be mailed to all the landowners and operators in the project area. Additionally, news articles relating to workshops, field days, and project information will be published in the local papers to publicize the project.

Project Period: October 1, 1997—September 30, 2002

Sponsor: Carroll County SWCD

Funding:		
	EPA/DNR	$257,555
	Nonfederal match	$171,705

Contact: Mr. David Cain
Carroll County SWCD
Route 1, Box 211C
Carrollton, MO 64633
(660) 542-3361

Bonne Femme Watershed Project

Residents of the Bonne Femme and Little Bonne Femme watershed in south central Boone County have formed a partnership to identify local water quality problems and to develop community-based strategies to reduce nonpoint source water pollution in the watersheds. The 92.4 square mile project area includes Rock Bridge Memorial State Park, Three Creeks State Conservation Area, and four officially designated outstanding state resource waters (i.e., Turkey Creek, Bass Creek, Gans Creek, and Devil's Icebox Branch). The watersheds include diverse aquatic habitats that are characteristic of prairies as well as Ozark forests. Several endangered species are present in the area, including the Gray Bat, Indiana Bat, and Topeka Shiner. There are also extensive areas of karst topography and numerous caves in the watersheds.

The project watersheds currently include a mix of cropland, pasture, forest, and residential developments. Economic pressures have been developing in recent years to expand residential, commercial and industrial development in the watersheds, especially along the Highway 63 corridor between Columbia and Ashland. This corridor is the headwaters for all major streams in the watersheds. Rapid and uncontrolled development in the Bonne Femme and Little Bonne Femme watersheds will significantly impact water quality in the outstanding state resources

waters, threaten several endangered species in the watersheds, and disrupt sensitive ecological systems in Rock Bridge Memorial State Park and Three Creeks State Conservation Area. In selected areas of the watersheds, agricultural practices and urban development have already degraded stream banks and riparian areas. Current and future urban nonpoint sources of water pollution in the watersheds include microbial contamination from on-site sewage systems; storm water from residential, commercial, and industrial developments; sediments from construction sites; and nutrients and pesticides from residential lawns and development grounds.

The proposed 319 project will focus on stream restoration and prevention of urban nonpoint sources of water pollution. The Boone County Soil and Water Conservation District has been funded by the Missouri Department of Natural Resources for a SALT AGNPS Project (Special Area Land Treatment - Agricultural Nonpoint Source) that will address agricultural nonpoint sources in the watersheds. A Watershed Steering Committee has been formed under the SALT AGNPS project and will be expanded to include additional stakeholders from the watersheds. The Steering Committee will set priorities, establish objectives, and help coordinate implementation of the project (USGS 1994). Project activities will be designed to increase watershed resident awareness and appreciation of water quality and stream issues, coordinate volunteer and agency resources for stream restoration, demonstrate urban best management practices, and provide technical assistance to watershed residents for implementing best management practices. Project activities will be supported and guided by professionals affiliated with conservation, agricultural, and health agencies operating in the watersheds. The project includes extensive inter-agency coordination between local, state, and non-governmental organizations.

Project Period:	August 1, 1998—July 31, 2002	
Sponsor:	Show-Me Clean Streams	
Funding:	EPA/DNR	$255,030
	Nonfederal match	$245,569
Contact Person:	James R. Davis, Ph.D. Show-Me Clean Streams 9642 South Route N Columbia, MO 65203 (573) 657-6108 (573) 882-3384	

North Fork Salt River Watershed ProjectProject

The Clarence Cannon Wholesale Water Commission (CCWWC) is a wholesale supplier of potable water to 16 rural water districts and communities in northeast Missouri. The North Fork Salt River of the Mark Twain Lake is the source of supply for this water purveyor. Mark Twain Lake is on the 303(d) list for Missouri due to atrazine levels found in the reservoir.

PROJECT DESCRIPITON

This project will work with community leaders to develop tools and resources for watershed management issues. The effort will focus on awareness of the water quality issues in the water shed and developing a model for these communities to use in developing their own management plan for the watershed. The target audience will be the community leaders in the North Fork Salt River watershed of the Mark Twain Lake and the CCWWC membership communities and counties. Funding for the project will come from 319 funds and local match funds provided by CCWWC and various project partners.

OBJECTIVES

1. Provide local community leadership with information about water quality issues and how their community affects the watershed.

2. Provide resources and training to local community leadership to address water quality issues and requirements such as TMDL's, source water assessment requirements under the 1996 SDWA amendments, compliance assurance implementation plan for CAFO's from EPA, etc., that will result in a community based effort to plan and manage water quality issues in the watershed.

3. Promote the building of relationships between local leaders, agricultural producers and local land owners and others so that networks can be developed that will aid in the development of local watershed management programs beyond the life of this project.

PRODUCTS

A quarterly newsletter will be published that will be aimed at the target audience and participating sponsors. A watershed management conference is planned as well as specific workshops on topics of interest throughout the project period.

Project Period: September 1, 1999—August 31, 2002

Sponsor: Clarence Cannon Wholesale Water

Funding: EPA/DNR $136,000
Nonfederal Match $93,600

Contact: Clarence Cannon Wholesale Water
34146 Route U
Stoutsville, MO 65283
Elizabeth Grove (573)-672-3221

Current Watershed-Based Implementation Projects

SUGAR CREEK LAKE PROTECTION AWARENESS PROJECT
Sugar Creek, which is on the 1998 303(d) list of impaired streams, is fed by Sugar Creek Lake. The Sugar Creek Lake watershed is unique in that none of the persons who have a direct impact

on the watershed get their residential water from the reservoir. This drinking water reservoir is impacted by agricultural, industrial and urban activities.

PROJECT DESCRIPTION

The Sugar Creek Lake Protection Committee is attempting to increase the stakeholders that impact the watershed through an educational effort. Stakeholder groups include landowners (shoreline, agricultural and residential), Sugar Creek Lake Park visitors, industry and business owners, teachers, and state and federal agency partners. The project will lead to increased awareness, interest and participation in the Sugar Creek Lake Watershed Protection Committee by stakeholders. Newsletter development and distribution, brochures for park users, educational meetings for watershed stakeholders, and a daylong science event about land and water stewardship at the local middle school will be held to increase awareness of nonpoint source pollution affecting the lake. Expanding stakeholder involvement in the planning committee by the end of the project will help lead to the development of a comprehensive watershed management plan for the Sugar Creek Lake Watershed.

OBJECTIVES

The objective of this project is to expand participation of stakeholder groups that impact Sugar Creek Lake through an educational effort focused on increasing awareness of watershed protection from nonpoint sources of pollution.

PRODUCTS

The products will be 5 newsletters, a brochure for park users, news releases/ media coverage, an attitude survey prior to and after a series of stakeholder meetings, a science event in a local middle school focusing on nonpoint source pollution issues, and two science fair awards for water quality projects.

Project Period: April 15, 2001—October 15, 2002

Sponsor: Randolph County SWCD

Funding: EPA/DNR $5000

Contact: Randolph County Soil and Water Conservation District
Rt. 3, Box 135
Moberly, MO 65270
Shelly Sumpter (660) 263-5702

FISHPOT CREEK WATERSHED RESTORATION PROJECT

The Fishpot Creek watershed covers 10.9 square miles and includes parts of seven cities and unincorporated St. Louis County. Rapid urban development has caused flooding, channel instability and degradation of water quality within the watershed's drainage network.

PROJECT DESCRIPTION

Stream channel management has been narrowly focused on maximizing flood conveyance. Borne of a historic need to carry raw sewage away from homes, this approach became established engineering practice in urban areas. It is costly and generally ineffective for several reasons. In general, flooding and channel stability is addressed only after municipalities receive complaints, making the approach inherently reactive. Although drainage networks are geomorphically interdependent, projects are designed reach-by-reach, with no watershed-scale geomorphic analysis. This approach both neglects proactive action (e.g. to protect stable areas from impacts), and fails to properly diagnose and treat the root causes of channel instability, flooding, and environmental degradation of channels and riparian corridors. Even when projects perform adequately within a given reach, they generally address only a single purpose (e.g., bank stabilization) at the expense of other values, such as riparian habitat. Moreover, these "repairs" often move stability and flooding problems elsewhere in the drainage network. In many cases, channel management projects have caused as much environmental and structural damage as the problems they were designed to solve.

PRODUCTS AND OBJECTIVES

These problems arise not from a lack of scientific and technical knowledge, but from poor integration of existing knowledge. Management of watersheds and drainage networks for their full potential requires an interdisciplinary approach that takes into account watershed-scale geomorphic processes to diagnose the real sources of problems and applies the appropriate built solutions in the appropriate locations. We have assembled a team of scientists and engineers with demonstrated capabilities in such state-of-the-art holistic management. Working closely with technical and policymaking stakeholders in Fishpot Creek's watershed, we propose to produce a management design for the watershed based on interdisciplinary diagnoses of management problems and state-of-the-art biotechnical solutions. Although watershed-scale, interdisciplinary approaches and biotechnical engineering have been widely advocated, they are still poorly understood and very rarely implemented. Thus, although widely advocated, this approach is still fundamentally new because it has been so rarely put to use. Using our team's demonstrated capabilities to apply this approach, we propose to:

- Perform a geomorphic and engineering analysis necessary to produce a holistic design for realization of the full potential of Fishpot Creek's watershed and drainage network.

- Work closely with professional and private stakeholders, demonstrate all aspects of this methodology and thus effect the paradigm shift necessary to properly direct stormwater and water quality protection funding to appropriate, multi-purpose, long-term solutions.

Project Period: November 15, 1999—November 14, 2002

Sponsor: St. Louis County Soil & Water Conservation District

Funding: EPA/DNR $245,600

Nonfederal Match $163,734

Contact St. Louis County SWCD
1215 Fern Ridge Parkway Suite 212
St. Louis, MO 63141-4406
Jackie Moore (314) 453-9555

HOMEBUILDERS ENVIRONMENTAL STEWARDSHIP DEMONSTRATION

The primary water resource to be protected by the project is Roubidoux Creek, with portions of the Gasconade and Big Piney rivers secondary. The Roubidoux runs generally north through the project area. The waters are public waters, used for recreation. Fort Leonard Wood utilizes the Big Piney for some of its water needs. The Waynesville Middle School Stream Team #218 monitors the Roubidoux.

The project area lies in the south-central part of Missouri within the Ozark Mountain Range. Of the approximate 353,000 acres, 57% is woodland, 35% is permanent pasture, 2% is cropland and 6% is urban. Within the project area is Ft. Leonard Wood (52,800 acres) and the Mark Twain National Forest (40,000) acres.

The area is predominantly rural, and beef cattle are the primary agricultural use. A few small dairy and swine operations still exist. Livestock numbers at last count indicated 24,400 beef cattle, 1200 hogs and 550 dairy cattle. The beef cattle industry comprises the majority usage of the pasture, primarily managed in conventional grazing systems.

While at present the project area is primarily wooded and pastoral, this landscape is due to change. With the expansion of Ft. Leonard Wood, approximately 1500-2000 new homes will be built for incoming personnel. Studies indicate that a significant amount of the construction will occur in the Waynesville/St. Robert communities. The Roubidoux Creek flows through the area.

An influx of this magnitude will be an economic boom to the local contractors and current landowners that wish to sell land parcels for development. However, the rush for financial gain will undoubtedly mean the conversion of pasture and woods to bare building sites. These sites can collectively become the primary sediment polluters to the nearby creeks, tributaries, and rivers. The impact of this increased sediment load could mean loss of volume, increased water treatment cost, and reduced recreational value.

PROJECT DESCRIPTION

Through voluntary participation, incentives and technical assistance will provide for properly sited and implemented practices. Each proposed participating homesite will be evaluated on a site-specific basis by a specialist hired specifically for this project. A written plan will be developed detailing which practices are recommended, design specifications and layout, technical notes and other pertinent data. Not all the offered homesites will require installation of all the practices listed for that targeted area, nor does every offered homesite have to participate in all four of the targeted areas.

PRODUCTS AND OBJECTIVES

A $2,000 maximum per homesite has been established for federal grant dollar incentives. To demonstrate effective erosion control, effective stormwater management on sites of less than 5 acres, and for water conservation, the usage of 50 homesites per practice will be developed with incentives to be offered at a 50% grant and 50% match rate utilizing one or more of the following practices. Landscaping will be promoted as a low cost effective means of achieving a variety of environmental goals. Xerophytic plants will be promoted for water conservation. Management of the project is being directed out of the Macon Water Quality Project Office and by the Natural Resources Conservation Service (NRCS) State Office. Technical specialists from the NRCS State Office, the University of Missouri Columbia (UMC), Extension Service (ES), the Missouri Department of Natural Resources (MDNR) and the Missouri Department of Conservation (MDC) are also available to provide technical expertise. The project funds are supporting personnel above the customary staffing level and water quality monitoring.

Project period:	December 15, 1998—December 15, 2002	
Sponsor:	Top of the Ozarks RC&D	
Funding:	EPA/DNR	$264,609
	Nonfederal Match	$183,800
Contact	Top of the Ozarks RC&, Inc. 6726D Highway 63 Houston, MO 65483 Lisa M. Ruller (417) 967-2028	

ED/INFO TO REDUCE WATER POLLUTION AND INCREASE MANAGEMENT PRACTICES IN SOUTHWEST MISSOURI

Southwest Missouri is a hilly region with predominately rocky substrate overlain by a thin layer of soil. The area supports pasture and grassland that is exceptionally suitable for the production of cattle and poultry. Nutrient-laden manure from the cattle and poultry industry has been identified as a major contributor to water quality degradation, hence making manure management on pastureland very important. Furthermore, septic system usage is largely unregulated and a

public education effort has been identified as being an important component of preserving or improving water quality in the region.

PROJECT DESCRIPTION

The University of Missouri Outreach and Extension will hire a project manager to develop and implement educational and training programs that emphasize best livestock manure management and provide information on available technologies and management practices to reduce nutrient and bacteria loading from on-site sewage systems. A multi-tier approach to the education/ information model will be implemented to assist producers and landowners in understanding regulations, identifying management practices and accelerating the adoption of practices.

OBJECTIVES

1. Accelerate the adoption of BMP's by local landowners to control nutrient run-off.
2. Increase landowner awareness of environmental concerns from poorly located or constructed on-site sewage systems.
3. Conduct educational classes, info meetings and demonstration/field days on water quality management planning, manure management, and on-site sewage systems.
4. Provide the course "Environmental Assessment for Real Estate Professionals".
5. Form watershed alliance groups.
6. Assist in the development of water quality management plans.

PRODUCTS

- Development and implementation of at least two water quality management plans.
- Six educational classes to identify best manure management practices and accelerate their adoption.
- Four classes entitled “Environmental Assessment for Real Estate Professionals.”
- Eight meetings to educate landowners on proper maintenance and management of on-site sewage systems.
- A “resource notebook” which will compile educational resources of water quality information.
- Six demonstration sites and field days to educate producers and landowners about water quality issues.
- Project brochure highlighting project goals and objectives.
- Reproduction of informational guides to promote BMPs.
- Pre/Post Surveys to show increased awareness and perception of the project goals.

Project Period:	December 15, 2001—November 30, 2004	
Sponsor:	University of Missouri-Columbia	
Funding:	EPA/DNR	$277,973
	Nonfederal Match	$190,858

Contact: University of Missouri- Columbia
Office of Sponsored Program Administration
310 Jesse Hall
Columbia, MO 65211
Bob Broz (573) 882-0085

VALLEY MILL LAKE AND WATERSHED RESTORATION PROJECT

The Valley Mill reservoir in northeast Springfield is part of the drinking water supply for the city of Springfield. The reservoir has become almost entirely silted in, and algae mats are common. The impacts of nonpoint source pollution are evident in the steambank erosion, increased sediment load, algae blooms, and obnoxious odors. The watershed contains several industrial complexes, a golf course, subdivisions, and the intersection of Hwy 65 and 44. The area is scheduled for increased urbanization.

PROJECT DESCRIPTION

Through this subgrant, The WCO will fund an environment assessment of the Valley Mill sub watershed. After the assessment, the WCO will target the areas of greatest sediment and nutrient contribution, and establish best management practices to reduce NPS pollution. WCO will then monitor the BMPs to determine their effectiveness. The WCO will also work with the city of Springfield to drain Valley Mill Lake, remove the sediments, and reinforce the dam. During the project, the WCO will introduce the education programs started in other sub watersheds. These include, but are not limited to, a kick-off dinner, earthday programs with school children, Show-Me Yards and Neighborhoods, and Business outreach activities sponsored by the Green County Choose Environmental Excellence Program. Finally, the WCO will plan and build a demonstration site for the community. Projects for the site include a trail, dock, wetland area, parking lot, and outdoor classroom. This will benefit the community by increased recreation, education, and watershed cohesiveness.

OBJECTIVES

1. Complete an environmental assessment of the pathways and amounts of nonpoint source pollution into the Valley Mill reservoir.
2. Develop a three stage educational program, targeting school children, businesses and landowners.
3. Restore Valley Mill reservoir and watershed
4. Create a demonstration site for the community, and
5. Create a monitoring program of the performance of restoration practices.

PRODUCTS

- An environmental assessment of NPS pollution concentrations and pathways through the sub-watershed.

- Area meeting will be held to disseminate information to watershed landowners, businesses, and public officials.
- A demonstration site will be created with the construction of a dock, trails, parking facilities and an outdoor classroom.
- Best management practices will be implemented based on the information and recommendations from the environmental assessment.
- A Quality Assurance Project Plan.
- A final written report, including all water quality data, will be submitted to the department upon completion of the project.

Project Period:	January 1, 2002—December 31, 2005	
Sponsor:	Watershed Committee of the Ozarks	
Funding:	EPA/DNR	$480,000
	Nonfederal Match	$440,838
Contact:	Watershed Committee of the Ozarks 320 N. Main Springfield, MO 65806 Loring Bullard (417) 866-1127	

LITTLE SAC WATERSHED RESTORATION PROJECT

The Little Sac River watershed encompasses about 400 square miles of the 1970 square mile Sac River basin in southwest Missouri. There are two drinking water reservoirs and one 27-mile stream segment within this watershed on the state's final 303(d) list. Nutrients and fecal coliform are pollutants responsible for the listing - nutrients for the two reservoirs and fecal coliform for the Little Sac River. Furthermore, the Sac River watershed is the #3 priority watershed in the recently completed "Unified Watershed Assessment." Concerns relate to nutrient enrichment, biological impairment, drinking water source protection, karst geology and large numbers of livestock in the basin. The entire Little Sac watershed is a public water supply source area containing two reservoirs; Fellows & McDaniel Lakes, plus Fulbright Spring and Stockton Lake, all utilized for municipal water supplies. The large intake on Stockton Lake is designed to serve the high growth areas of Springfield and Greene County for the next fifty years. From the drinking water source protection standpoint, the pollutants of greatest concern are nutrients and sediment. Therefore, these pollutants will be the priority targets for this restoration project.

PROJECT DESCRIPTION

The Watershed Committee will provide overall coordination for the project by utilizing federal 319 funds and match funds to hire a Project Coordinator. City Utilities and the Watershed Committee will provide analytical support, the Missouri Department of Conservation and Soil and Water Conservation Districts will provide technical assistance and the Watershed

Committee, Southwest Missouri State University, and Stream Teams will provide monitoring support. Monitoring will occur in two phases. Through a 104(b) cooperative proposal with the USGS, sources and types of fecal bacteria in the watershed will be evaluated and nutrient and sediment levels will be assessed, both at base flows and during storm events. Though this federally funded project will not be used as a cost-share, it will provide the nonpoint source project with a better focus for implementing a monitoring program. Complementing this generalized sampling program will be a focused, sub-watershed specific monitoring program conducted jointly by Southwest Missouri State University, City Utilities and the Watershed Committee. This program will look more closely at water quality in each of the six identified sub-watersheds as well as providing evaluation for restoration sites implemented during the project.

OBJECTIVES

Practices implemented through the project will focus on nutrient management in riparian zones and channel stabilization and will include planned grazing systems, pasture enhancement, alternative watering systems, livestock exclusion, bank stabilization, and relocation of feeding areas. Cost-share may be used to supplement and enhance existing programs such as EQIP and Streams for the Future. Restoration efforts will be directed toward those practices that will help to remove water bodies from the 303(d) list. On-site wastewater and abandoned wells could be included if identified by guidance teams or focused monitoring as priority concerns.

PRODUCTS

Educational efforts implemented will support and complement monitoring and restoration components. For example, sub-watershed guidance team will help to define specific monitoring strategies and tailor outreach efforts to landowners. Surveys will be used to help discern landowner attitudes about cost-share. Field days and workshops will be conducted in each sub-watershed to support restoration efforts. A portion of the education/outreach activities will also focus on sediment and erosion control workshops for developers and contractors. A 'Developer of the Year Award' will be presented to the developers that implement best management practices. These activities will be helpful in addressing the urban impacts of non-point source pollution in the Little Sac watershed.

Project period:	October 1, 2000—September 30, 2005	
Sponsor:	Watershed Committee of the Ozarks	
Funding:	EPA/DNR	$343,500
	Nonfederal Match	$$281,500

Contact: Watershed Committee of the Ozarks
320 North Main
Springfield, MO 65806
Loring Bullard (417) 866-1127

UPPER REACH SPRING RIVER 319 PROJECT

The Lawrence County, Missouri, portion of the Upper Spring River Hydrologic unit is approximately 271,000 acres. The project area measures 130,598 acres and is composed of four, fourteen-digit hydrologic units, and includes a small area in Barry County, Missouri. It is primarily agricultural, with the dominant land use being pasture. Approximately 30 percent is forested. The watershed has a high density of poultry and cattle. Lawrence County ranks first in the number of cattle in Missouri. Major tributaries in the Lawrence County portion of the Upper Spring River include upper reaches of the Upper White Oak Creek, Stahl Creek, Truitt Creek, Williams Creek, Honey creek, and Upper Center Creek. The cities of Aurora, Freistatt, Marionville, Miller, Mount Vernon, Stotts City, and Verona, Missouri are located in the basin. There are 45 known dairy farms and 22 poultry facilities in the project area. The animal waste from these facilities poses a threat to the area water resources, through runoff and through direct access of cattle to the streams.

PROJECT DESCRIPTION

A nutrient management specialist will be hired as the project manager to develop a formal nutrient management school curriculum. This curriculum will be implemented to educate producers in the project area. Area producers will also be involved in restoration projects for riparian buffers and wetlands, and will be educated on evaluating the condition of their streams. Financial assistance will be provided to the participants in the restoration activities and for those that construct animal waste facilities. Stream Teams will collect data in selected locations during the project period. Field days and tours will demonstrate the best management practices used by the landowners that participate in this project.

OBJECTIVES

1. To develop and apply sound comprehensive nutrient management plans for livestock feeding operations in the project area.
2. To provide for restoration of riparian corridor.
3. To provide for restoration of wetlands.
4. To increase awareness and educate landowners and producers about ways to reduce nonpoint sources of pollution from entering the creeks and streams, through the use of best management practices.

PRODUCTS

A Quality Assurance Project Plan (QAPP) for testing and monitoring activities, three nutrient management schools, two new Stream Teams, 5 producers trained in the use of Stream Visual Assessment Protocol (SVAP), restoration of 25 acres of wetland, protection of 20 miles of riparian corridor, development and follow-up on 50 comprehensive nutrient management plans

(CNMP) for producers, construction of 6 dairy waste management facilities and 10 poultry waste management facilities, 2 tours and 3 field days.

Project Period: June 1, 2001—May 30, 2006

Sponsor: Lawrence County SWCD

Funding: EPA/DNR $766,903

Contact: Lawrence County SWCD
10733 Highway 39
Mt. Vernon, MO 65712
Paula Champion (417) 466-7682

Elk River Water Quality Demonstration

The 483,000-acre Elk River Basin located within Missouri consists of Indian Creek, Little Sugar Creek, Big Sugar Creek, Buffalo Creek, Elk River, and their tributaries. The watershed is located in the most southwestern part of Missouri in McDonald, Newton, and Barry counties. The Elk River flows westerly, entering Grand Lake of the Cherokees north of Grove, Oklahoma. The entire Elk River Basin drains about 870 square miles in Oklahoma, Arkansas, and Missouri.

Approximately 6,000 people live in the Elk River Basin. The basin is estimated at 68 percent grassland, 25 percent forest land, and 7 percent other--water, roads, farmsteads. There are about 1,500 farms/cooperators in the watershed (about 275 of these are confinement operations). Sources of pollutants within the Elk River Basin may include municipal and septic system wastes, livestock and poultry manure/litter, fertilizers, pesticides, sediment/erosion, and recreational use of the streams (human contact with streams and trash).

The Elk River, along with the Neosho and Spring rivers, flows into the Grand Lake of the Cherokees. According to a Missouri Department of Natural Resources (MDNR) report on the Grand Lake of the Cherokees, fecal strep and certain nutrients including phosphorus and nitrogen have been identified as posing a threat to the overall quality of that lake. Therefore, excessive nutrients are potential problems and concerns to the tributaries, springs and ground water resources within the drainage basin of the Grand Lake of the Cherokees.

PRODUCT DESCRIPTION

This project will compliment the existing Poultry Litter/Nutrient Management Demonstration in the Upper Shoal Creek Watershed. In the Shoal Creek 319 project, poultry litter and soil samples are being taken on ten demonstration farms to develop nutrient budgets that tell how much litter should be applied to the land. Information learned from the Upper Shoal Creek Watershed will be used to the benefit of the cooperators and residents in the Elk River Basin and the rest of the poultry producing counties. The Elk River Water Quality Demonstration will show various practices. Landowners will be able to visit nearby farms within the basin to learn techniques to improve water quality.

OBJECTIVES

The purpose of this project is to help prevent pollution through the use of demonstrations, water and soil quality monitoring, information/education, and technical assistance. The project will demonstrate four poultry litter stacking shelters, two litter hauling seminars, six grower nutrient management sites, two septic system maintenance/clean-outs, three riparian corridor repair and management sites, and three livestock and pasture management systems. The Elk River Water Quality Demonstration project will illustrate various practices that if implemented will contribute to improved water quality in the watershed.

PRODUCTS

An Elk River Basin brochure will be produced to increase water quality awareness. Stacking shelter guidance materials will be produced and distributed. Soil samples will be taken on farms

within the watershed during the project period. A video will be produced explaining nutrient management. Fact sheets, newsletters, news releases, and radio programs will be used to promote the practices demonstrated through the project.

Project period: January 1, 2000—December 31, 2004

Sponsor: Southwest Missouri Resource Conservation and Development Council, Inc.

Funding: EPA/DNR $454,400

Contact: Southwest Missouri Resource Conservation and Development, Inc.
329 W. Highway 60
Republic, MO 65738
Rita Mueller telephone: (417) 732-6485

ELK RIVER/SHOAL CREEK WATER QUALITY RESTORATION PROJECT

The Elk River/Shoal Creek Watersheds lie within McDonald, Newton, Barry, and a small portion of Lawrence County in the southwest corner of Missouri. Streams and rivers within these watersheds are public drinking water sources that are used heavily for floating, camping, and whole body contact recreation activities. The Elk River basin has 126.5 miles of stream segments impaired due to nutrients from nonpoint source pollution from livestock production. Shoal Creek has 13.5 miles of impaired streams due to fecal coliform from unknown agricultural sources. These watersheds have experienced an increase of about 15 percent in residential population this past decade and a rapid expansion in the poultry industry. This increase in poultry production has created serious concerns about the impact on the water quality due to land application of poultry waste. Currently in the Elk River Basin there are 31 Class I poultry facilities, 116 Class II, and 37 with operations smaller than Class II with Letters of Approval based on best management practices.

PROJECT DESCRIPTION

This project will implement best management practices which include: development and implementation of comprehensive nutrient management plans (CNMPs); transport of poultry litter out of the watersheds to areas of intensive crop production; construction of poultry litter stacking sheds; tarps to prevent runoff from stored litter; pH correction of soils on farms utilizing CNMPs; piloting of livestock watering wells with rotational grazing systems; and livestock exclusion from streams. This project will be coordinated with other 319 projects in the area for outreach and education that will focus on proper nutrient management of poultry and livestock wastes.

OBJECTIVES

1. To develop Comprehensive Nutrient Management Plans (CNMPs) on 100 farms (about 15,000 acres) to prevent overapplication of nitrogen and phosphorus to soils.
2. To record the amount of litter that is being applied according to CNMPs in the watershed.
3. To increase nutrient uptake on 6,000 acres under CNMPs by correcting soils with a pH below 5.8, thus reducing nutrient runoff.
4. To construct 24 manure storage sheds to enable proper timing of nutrient application and prevent uncovered outside storage of litter. This will allow approximately 326 tons of nitrogen and 326 tons of phosphate per year in the litter to be managed properly so risk of runoff into waterbodies is reduced.
5. To reduce runoff from 100 tons of litter per tarp (10 tarps) so litter can be temporarily stored in close proximity to an area that is in need of the nutrients. This will aid in management of 2.5 tons of nitrogen and 2.5 tons of phosphate/tarp/use. The tarps will be used in a watershed not listed for nutrients on the 303d list.
6. To demonstrate the feasibility of transporting 3,200 tons of litter containing approximately 80 tons of nitrogen and 80 tons of phosphate out of the watershed.
7. To protect streams from sedimentation and fecal contamination from livestock on 20 farms or 5 miles of stream.
8. To construct wells to supply water for managed grazing systems when this is the least cost and most environmentally beneficial option for livestock drinking water.
9. To hire a project coordinator, technician, and clerk to accomplish the above objectives.
10. To contact landowners with current animal waste plans for review and update to CNMPs on 50 farms.
11. To promote the goals and successes of the Elk River/Shoal Creek Water Quality Restoration Project to the media and to the public through the current Elk River Water Quality Demonstration 319 Project.
12. To aid in quantification of the nutrient problem in the watershed through compilation of soil and litter analyses.
13. To provide progressive photographic documentation of all tasks listed in milestones. At minimum this would include photos of " before and after" installation of BMPs.

PRODUCTS

Expected products will include 150 comprehensive nutrient management plans; 24 manure storage sheds, pH correction on 6,000 acres; 10 litter storage tarps; feasibility study of litter transport to intensive crop production areas in need of nitrogen and phosphate fertilizers; 20 livestock watering wells in combination with rotational grazing systems; compilation of soil and litter analyses as an indicator of quantification of the nutrient problem in the watersheds; exclusion fencing on 5 miles of riparian corridor; and photographic documentation of all the tasks included in the milestones.

Project Period: July 1, 2002—June 30, 2006

Sponsor: McDonald County Soil and Water Conservation District

Funding: EPA/DNR $1,258,596

Contact: McDonald County Soil and Water Conservation District
1900 South Hwy. 71
Neosho, MO 64850
Lynn Jenkins (417) 451-1366, Ext. 3

BRYANT CREEK TRIBUTARIES WATER QUALITY DEMONSTRATION PROJECT

The proposed boundary of this watershed project is Bryant Creek and its tributaries within Douglas and Ozark counties. Bryant Creek empties into Norfolk Lake, a public water supply for the city of Mountain Home, Arkansas. The watershed is approximately 250,000 acres with more than 70 dairies, approximately 5,000 head of dairy cattle and an estimated 14,000 head of beef cattle. The water quality of Bryant Creek and its tributaries is potentially degraded by the presence of these dairy and beef cattle operations. Animal wastes, coming off-site from concentrated animal feeding areas, dairy milking parlors, loafing areas, improper rates and timing of manure applications to overgrazed fields and from direct deposition of animal wastes into creeks, have negative impacts on fish and other wildlife dependent on the streams for habitats and also for recreational users of the water resources.

The primary impacts the animal wastes have on Bryant Creek watershed are nutrient loading through runoff. The nutrients of concern are nitrogen and phosphorous. High bacteria levels (fecal coliform and fecal streptococcus) and other pathogens are also a concern to recreational users of Bryant Creek, particularly swimmers, fisherman and canoeists. Douglas County and Ozark County rank 7th and 14th respectively in the state in milk cows and 21st and 33rd in the state respectively in beef cattle. Livestock wastes produced from these enterprises are considered to be a major water quality concern along with the excessive sedimentation caused by erosion in over-grazed pasture land and the lack of established riparian areas along streams of the watershed. Within the proposed project area, there are currently only two permitted dairies, one in Douglas and one in Ozark County. The upper end of the watershed, located in north central Douglas County, has the greatest concentration of animal feeding operations with more than forty dairies.

The NRCS will hire a full-time nutrient management specialist/conservationist whose primary responsibility will be to coordinate the activities of the project area. Technical support will also be provided by NRCS field office and area office staff in the design and installation of animal waste management systems. These NRCS staffs will also provide assistance in developing resource and nutrient management plans for landowners in the watershed area. Staff will develop 40 nutrient management plans written to address the vegetative filter strips along concentrated animal feeding/traffic areas, proper nutrient management through proper timing and spreading of manure applications, and intensive/rotational grazing systems establishment.

There will be three animal waste management demonstration farms installed, four grazing management demonstration farms installed, and three riparian corridor management protection farms installed with alternative watering systems demonstrated. Once these demonstration farms have been established, there will be one tour or field day the first year demonstrating an intensive/rotational grazing system; two the second and third years demonstrating animal waste management systems, intensive/rotational grazing systems, and riparian corridor establishment and protection with alternative watering systems; and four the fourth and fifth years demonstrating the same systems as shown in the second and third years. To complement these animal waste demonstration systems and to assist other operations within the watershed in the proper utilization of animal wastes, animal waste spreading equipment will be purchased the first year of the project.

There will also be volunteer monitoring of Bryant Creek to determine trends in water quality within the stream. Stream teams trained in water quality monitoring will conduct this monitoring.

Information, education and technology transfer will be accomplished through the use of informational materials, demonstration field days, news articles, SWCD newsletters, radio public information programs and the Neighbor-to Neighbor program sponsored by the Douglas and Ozark County SWCDs. Soil and effluent testing, along with volunteer stream team monitoring, will also be methods by which this is accomplished. The target audience will primarily be beef and dairy producers within Bryant Creek watershed.

Successes will be documented by the implementation of BMPs that will be written into resource and nutrient management plans for landowners in the watersheds. The BMP implementation used to measure the success of this project will be the installations of successful animal waste management systems, acres of pasture land put under intensive/rotational grazing management systems, lengths of riparian corridors established and streambanks stabilized and protected, numbers of alternative watering systems installed, tons of manure properly utilized, and general changes of attitudes by landowners in the watershed as determined by surveys.

Project Period:	November 15, 1997—November 14, 2003	
Sponsors:	Douglas and Ozark Counties' Soil and Water Conservation Districts	
Funding:	EPA/DNR	$474,086
	Nonfederal match	$328,390

Contact: Mr. Gregory B. Watkins
Douglas County SWCD
P. O. Box 837
Ava, MO 65608
(417) 683-4816

SMITHVILLE LAKE WATERSHED

The Smithville Lake and Upper Platte River Water Quality Project supports technical assistance for the Clinton County Soil and Water Conservation District (SWCD) to provide an integrated crop management (ICM) specialist in the watershed. The specialist is employed by the Clinton County SWCD and is stationed in the Plattsburg, Missouri office.

Smithville Lake supplies drinking water for the cities of Smithville, Plattsburg, Edgerton, Tracy and seven water districts serving over 15,200 residents. The lake is heavily used for recreational purposes including camping, boating, fishing, skiing and swimming.

The 126,000-acre drainage area contains 475 farms with 32 percent in cropland and 59 percent in pasture. Farms are primarily crop and livestock operations with the average farm having 80 to 150 acres of row crops consisting of a corn-soybean rotation.

While levels of fecal coliform, iron and manganese have exceeded the maximum allowable standards at times, pesticide concentrations, particularly atrazine, are the major concern. Samples taken in 1994 showed concentrations ranging from 2.5 - 6.1 ppb (parts per billion) with an average of 2.5 ppb. Quarterly samples of finished drinking water showed mean concentrations of 1.9 ppb for 1994, 2.7 for 1995 and 2.4 for 1996. Mean concentrations remained below the 3.0 ppb standard, however, spikes above the standard did occur. The occasional spikes indicate mean concentrations could exceed the limit depending on crops produced and the timing and severity of rainfall events in any one year. Protection of the drinking water supply by controlling surface runoff to reduce pesticide delivery and control soil erosion are the two major issues to be addressed in the management of agricultural lands draining into Smithville reservoir.

Sponsor objectives are: (1) to provide direct technical assistance to producers in the project area to plan and implement nutrient-pesticide management plans for reducing and controlling nutrients (N, P, K) and pesticides from agricultural land uses in the project area; (2) to assist area producers in utilizing state SALT (Special Area Land Treatment) cost-share funds, primarily for structural measures for reducing and controlling the volume of sediment leaving the fields and being deposited in Smithville Lake; and (3) to assist producers in utilizing Food and Security Act (FSA) funds, Water Quality Incentive Program (WQIP) funds from the US Department of Agriculture (USDA) for reducing and controlling nutrients (N, P, K) and pesticide concentrations leaving the fields in surface runoff or by leaching into the groundwater.

Project Period: 1995—2003

Sponsor: Clinton County SWCD

Funding:	EPA/DNR	$288,000

Contact: Clinton Co. SWCD
1800 W. Highway 116
Rt. 2, Box 161 A
Plattsburg, MO 64477-9528
(816) 539-3741

HUBBLE CREEK WATERSHED RESTORATION PROJECT

Hubble Creek watershed contains 44,875 acres of productive land in southern Cape Girardeau County, Missouri. Hubble Creek is suffering from water quality problems due to sediment. High concentrations of sediment in runoff water leave Hubble Creek and enter the Mississippi River. The sources of sediment are both agricultural and urban. These sediment sources can be attributed to dramatic changes in the watershed's ecosystem during the last century. Changes affecting the lower reaches of Hubble Creek cause instability and headcutting. These factors allow vast amounts of sediment to remain in suspension and be delivered through the outlet and into the Mississippi. Dramatic changes in the upper reaches of the watershed greatly increase runoff to deliver higher sediment loads to the streams.

PROJECT DESCRIPTION

This 319 funded Hubble Creek Watershed Restoration Project is the initial phase of the larger watershed improvement plan. Section 319 funds will be used to prevent nonpoint source pollution and restore water quality through the following mechanisms:

1. Offer additional incentive to CRP applicants who restore riparian buffers and establish innovative cross-corridor buffers.
2. Demonstrate the effectiveness of wetland filter areas by constructing one such area downstream from concentrated livestock operation.
3. Construct a rip-rap and sheet piling stabilization structure in a stream channel to control headcutting and stabilize streambank erosion.
4. Provide partial funding for a project manager who will manage these efforts and eligible portions of the larger Hubble Creek Watershed Improvement Plan during the term of this project.
5. Assist decision-makers in developing and implementing city and county ordinances for construction site erosion control and stormwater detention.
6. Provide partial funding for the information and education activities that are critical to this project's success.

OBJECTIVES

1. The primary objective of this project is to restore more favorable water quality conditions within the Hubble Creek watershed. Sediment is the primary water quality problem in this watershed. The project objective is to reduce sediment load to the stream by 20%. This project will use funds from the 319 program to:

-Develop and implement an information and education strategy and plan. This plan will be comprehensive and for the life of the 319 project. It will include publicizing the project's progress, monitoring and evaluation results and implementation. The plan will educate stakeholders and the public about the problems in the watershed and what services they can utilize through the project to help address problems. This will include efforts to make the stakeholders aware of the project, it's goals and who the partners and sponsors of the project are. This information and education plan will also include a process for stakeholders to have an opportunity to contribute to and get involved in the project. Development and implementation of this plan will be the responsibility of the sponsors and their staff. This plan will be submitted to the department for review and approval.

-Restore water quality by helping Cape Girardeau County and the city of Jackson develop and implement effective Stormwater Detention and Construction Site Erosion Control Ordinances. These ordinances and their enforcement will help control excessive runoff from new development sites in Jackson and the surrounding area. Goal will be to assist the city and county in enacting effective ordinances during the life of this project.

-Restore riparian buffers along Hubble Creek and its tributaries. 319 funds will provide additional cost-share to supplement the Conservation Reserve Program (CRP) program for establishing riparian buffers. Currently, CRP pays 50% of the cost to establish/restore buffer strips. Participation is very low. This project will furnish an additional 25% to increase that incentive to 75%. These buffers will control erosion and remove sediment and debris as water enters and leaves the streams. Buffers will also improve aquatic habitat. Goal is to restore 20 miles of buffer strips along streams.

-Restore water quality by establishing vegetative buffers across the flood corridors of the streams. These cross-corridor buffers will control erosion and remove sediment as flood water travel across the flood corridors. This is an innovative practice to improve water quality and wildlife habitat. A similar practice, developed with the Corps of Engineers in 1984 for Thompson Bend along the Mississippi River, has been largely successful. CRP would pay 50% to establish these strips. This project will provide another 25% for establishment. Goal is to establish 15 miles of these innovative strips across the flood corridors.

-Demonstrate improved water quality by constructing an off-stream wetland filter area downstream from a damaging pollution site. Goal is to establish one wetland filter area of 5 acres.

-Demonstrate the effectiveness of a rip-rap and sheet piling structure in the stream channel to control headcutting and streambank erosion. According to MDC stream managers, this type stabilization is necessary to stop headcutting and preserve stable streambanks before the riparian buffers can be expected to be effective. One structure needs to be constructed for demonstration and technology transfer. This type of structure has not been used in this area. Goal is to install one rip-rap and sheet piling structure.

-Pursue other funding sources to enhance or continue the efforts to reduce nonpoint source pollution and restore water quality. The 319 funds will not be used to plan, design, promote or construct structures or practices where the primary purpose is for flood control.

-Monitor and evaluate the 319 project's effectiveness throughout the life of the project. This will include water quality monitoring and evaluation of effectiveness of installed practices. This information will be used as a measure of success and also as a basis for any adjustments for the purpose of improvement. QAPP will be developed and in place to be used as a guide for monitoring and sampling for the project.

2. Another objective is to partially fund the broader Hubble Creek Watershed Improvement Plan. The watershed improvement plan represents a holistic approach to dealing with problems in this watershed. Other programs, other funding sources and other authorities will be required over the next several years to carry out the entire watershed improvement plan.

PRODUCTS

- Develop and implement Information and Education Plan.
- Install 20 miles of Riparian Buffers.
- Install 15 miles of Cross-corridor Vegetative Buffers.
- Implement Stormwater Detention and Construction Site Erosion Control Ordinances for Jackson and Cape Girardeau County. Goal is to limit runoff from new development not to exceed pre-development conditions according to USDA-NRCS Technical Release - 55 standards.
- Install demonstration Wetland Filter Area.
- Install demonstration Rip-rap and Sheet-piling Grade Stabilization Structure.
- Pursue other funding sources to carry out Hubble Creek Watershed Improvement Project.
- Reduce sediment loss from gully, sheet and rill, scour and streambank erosion by 20 percent in the Hubble Creek Watershed.

Project Period:	March 1, 2001—February 28, 2006	
Sponsor:	Cape Girardeau County SWCD	
Funding:	EPA/DNR	$237,300

Contact: Cape Girardeau County SWCD
480 W. Jackson Trails
Jackson MO 63755
Stan Murray (573) 243-1467

ELK RIVER BASIN MONITORING

The Elk River watershed is located in the extreme southwestern corner of Missouri. Increased agricultural, industrial, residential and recreational demands have raised concerns regarding the maintenance of water quality in this area. A five-year water quality study was conducted from 1989-1993 to develop baseline information on the region's water quality during runoff and non-runoff periods. The proposed project will continue gathering water quality data by monitoring several stations established during the 1989-July 2001 study, with collection events occurring at random hydrologic conditions 18 times/year.

Historical Data: A number of water quality studies concerning the Elk River basin have been undertaken since 1964. These reports are on file with the department's WPCP. The United States Geological Survey (USGS) has a permanent monitoring location at the Tiff City Gauging Station on the Elk River. Records have been maintained on greater than 80 water quality parameters at this site from 1960 to the present.

PROJECT DESCRIPTION

The Missouri Department of Conservation will use funding to support two workshops targeted at developers, builders and professionals in stormwater. The purpose is to introduce the methods and benefits of Best Management Practices (BMP's) to these professionals so they can incorporate these BMP's in future planning and development. Also, funding will be used to develop publications and information packets that support these workshops and also for use by others.

Study Area: The Elk River and Shoal Creek watersheds is located within Barry, McDonald and Newton counties in southwestern Missouri. The southernmost reaches of the watershed are located within the north Arkansas county of Benton. The watershed encompasses a total of 1600 square miles and has approximately 170 miles of permanently flowing streams. The major streams include Shoal Creek, Big Sugar Creek, Buffalo Creek, Elk River, Indian Creek, Little Sugar Creek and Lost Creek. Lost Creek, located in western Newton County, will not be considered in this study.

OBJECTIVES

1. Gather water quality information for the Elk River basin including:
   (a) Seasonal water quality conditions of streams.
   (b) The quality of the stream's water during normal flow.
   (c) The quality of the stream's water during periods of high runoff.
   (d) Stream areas influenced by nonpoint source runoff.

2. Determine whether changing land use patterns are altering or degrading surface water

quality;

3. Assess the need for further water quality studies in the Elk River Basin;

4. Provide data for the development of nutrient TMDLs for streams in the Elk River basin in Missouri

PRODUCTS

The following analyses are being performed on the samples:

- Specific Conductance
- Temperature
- Nitrite & Nitrate Nitrogen
- Ammonia Nitrogen
- Total Phosphorus
- Fecal Coliform
- Fecal streptococcus
- Total Suspended Solids

In addition, comments concerning the general condition of the stream at each sampling station (i.e., relative discharge and water clarity) is made each sampling date. Data is being reported biannually in a tabular format; a summary of QA/QC information is accompanying the data.

The data from this study will be provided for the development of nutrient TMDLs for streams in the Elk River basin in Missouri.

Project Period: August 15, 2001—August 14, 2004

Sponsor: Crowder College

Funding: EPA/DNR $90,900

Contact: Crowder College
601 Laclede Avenue
Neosho MO 64850
Deron Allen (417) 451-3583

LITTLE NIANGUA WATERSHED RESTORATION

The Dallas County Soil & Water Conservation District in partnership with the Hickory and Benton County Soil & Water Conservation Districts were awarded an $82,200 grant for the first year of a five-year water quality project.

OBJECTIVES

The project will support the restoration and protection of streambanks and the establishment of rotational grazing systems with alternative water supplies. Tours and demonstrations will be given to create public awareness of how water quality and the environment are protected by the adoption of best management practices.

PRODUCTS

- Alternative watering systems.
- Fenced paddocks.
- Educated livestock producers.

Project Period: May 15, 1999—May 14, 2004

Sponsor: Dallas County SWCD

Funding: EPA/DNR $265,296

Contact: Dallas County Soil and Water Conservation District
RR 3, Box 80, S Hwy. 65
Buffalo, MO 65622
Joe Cooper (417) 345-2312

RACCOON CREEK WATERSHED PROJECT

The Raccoon Creek Watershed is a located north of highway 6 and west of Crowder State Park in western Grundy and eastern Daviess county in north central Missouri. The Raccoon Creek drainage area includes approximately 15,000 acres. Raccoon Creek feeds into Sugar Creek near Brimson, Missouri.

The water quality problems being encountered or threatened include loss of habitat of the Topeka Shiner, which is directly related to sedimentation of the stream channel, loss of riparian corridor, loss of native prairie, loss of wetlands, sedimentation of raccoon Creek, overgrazed and under managed pastures, and erosion of cropland.

Many of these problems are interrelated. For example, cattle are allowed direct access to the stream in many places and tend to linger in the stream or on the shaded banks, especially in the summer. This damages the trees and causes loss of riparian areas, and stream bank erosion, which in turn causes sedimentation of the stream. Cattle in the stream also cause excessive nutrient and other problems. These effects combine to cause damage and loss of habitat for the Topeka Shiner, which is already a candidate species for listing as endangered.

PROJECT DESCRIPTION

The grant funds will be used to hire a project manager, to support a part-time clerical staff for project administration and to provide for supplies, travel, training and other associated expenses as approved by MDNR. The project will also offer technical support to help construct terraces, grazing systems, filter strips, riparian forest buffers, conservation cover, residue management, critical area treatment, grass waterways, water and sediment basins and prescribed burning. The project will demonstrate best management practices for lawn care, human effluent, modified tile outlets, and the development and implementation of integrated crop management (ICM) plans. Tours and demonstrations of BMPs such as modified tile outlets, ICM plans, grazing systems, and proper installation of septic systems will be given to create public awareness of how water quality and the environment are protected by the adoption of these practices in partnership with other funding sources.

OBJECTIVES

1. Provide technical assistance to Rural communities and farmers in the Raccoon Creek Watershed in order to implement restoration and demonstration practices for the purpose of improving and protecting water quality in Raccoon Creek and its tributaries;
2. To emphasize personal and environmental advantages of such practices to producers and to encourage them to adopt and maintain those practices long-term;

PRODUCTS

Develop MOU with Daviess, Harrison, Grundy counties; Developed WRAS; 15 acres of riparian forest buffers; 15 acres of filter strips; 250 acres of native prairie; 5 acres of wetlands; 5 tours/field days; 2,000 acres of conservation cover; 1,200 acres of conservation crop rotation; 25 acres of critical area treatment; 15 acres of grade stabilization structures; 5 grass waterways; 5 water and sediment basins; 200 acres of cropland converted to pasture/hayland; 10,000 feet of terraces; 7,500 feet of underground outlets; 1 modified tile outlet terraces demonstration; 5 well decommissioning; 500 acres of upland wildlife habitat management; 1,200 acres of residue management; 300 acres prescribed grazing demonstrations; 1 prescribed burns; 1 residential runoff demonstration; 20 radio programs; 5 school programs; 20 newsletters; 3,000 acres of ICM plans developed and implemented.

Project Period: July 1, 2000—June 30, 2005

Sponsor: Grundy County Soil and Water Conservation District

Funding: EPA/DNR $215,600

Contact: Grundy County Soil and Water Conservation District
3414 Oklahoma Ave
Trenton, MO 64683
Scott Roy (660) 359-5685 ext 3

JAMES RIVER WATERSHED 319 PROJECT

Flowing through the heart of the Ozarks, the James River is currently listed on the 303d list (59 miles affected) and also ranked number 5 out of 66 watersheds on the Unified Watershed Assessment (UWA). Maintaining water quality is crucial to the watershed's economic well being. Tourism contributes billions of dollars into the area economy and supplies jobs for thousands of citizens each year. In 1998 alone, 6.2 million visitors came to Table Rock Lake to recreate, fish and enjoy its scenic beauty - tourists will not come to visit a green, murky, algae-filled lake.

The alarming fact is that water quality trends in the watershed are on the decline. The James River is threatened by many sources both point and non-point pollution. Point source contributions for phosphorous, are currently being addressed by state and local governments. This project will address the contribution of non-point sources.

PROJECT DESCRIPTION

Three 14-digit sub-watersheds in the James River Basin have been targeted for specific restoration activities other activities will be carried out in the entire James River Basin. "Upper Flat Creek", "Urban Target" and "Lower Finley/Elk Valley" are 3 sub-watershed selected. Several practices will be implemented in the agricultural watersheds (riparian corridor restoration, sinkhole protection, well plugging, and nutrient management). Additional practices will be implemented in the urban watershed (soil test rebates for lawns and septic tank maintenance assistance).

A qualified, trained Project Manager (NRCS staff) will spend 100% of their time on the restoration component of this project. The James River Basin Partnership will lead the technology transfer portion. Numerous water quality information, education and action activities will be carried out in the James River watershed by the JRBP and its members and friends.

OBJECTIVES

1. Aid restoration in three prioritized 14-digit HUC watersheds through the implementation of Best Management Practices.
2. Provide an effective information/education campaign to benefit the entire basin. This project will also continue the efforts to complete a watershed assessment based on scientific data.

PRODUCTS

Restoration goals (products) for this project include: 110,000 ft riparian forest buffer, 15 nutrient management plans, 400 urban soil tests, septic tank maintenance for 15 septic tanks, 15 wells and/or cisterns decommissioned, 25 sink holes protected, 5500 acres of planed grazing systems, 1100 acres of woodlands exclude from livestock, 750 acres of pasture improvement and/or establishment. A WEND model will be used to measure the impact of the restoration goals. In addition to the restoration goals we will produce many items for public education and awareness programs (newsletter, septic tank brochures and many public meetings of varying format). We will track the numbers of people reached by these efforts.

Project Period: August 1, 2001—July 30, 2006

Sponsor: James River Basin Partnership

Funding: EPA/DNR $626,350
Nonfederal Match $417,567

Contact: James River Basin Partnership
Holland Building, Suite 204
205 Park Central East
Springfield, MO 65806
Diana Sheridan (417) 836-8878

WATERSHED RESEARCH AND STEWARDSHIP PROJECT

The overall goal concerning environmental issues for Missouri Corn Growers Association (MCGA) is to continue to provide leadership in the water policy determination process and to champion Missouri's corn growers as good stewards of the land, water and other natural resources. MCGA is continuing to work to develop alliances and assist producers in deciding which farming practices will provide even better protection for the state's natural resources while maintaining or enhancing profitability.

To gain information that will provide a better understanding of the variables which affect the quality of water in runoff from agricultural fields. This project will help accelerate the implementation of farming practices that improve water quality while maintaining or improving farm profitability. This project will also enable policy-makers to make more informed decisions based on accurate information. This project is specifically designed to facilitate fair implementation of the state Total Maximum Daily Load (TMDL) program under Section 303 of the Clean Water Act and development of voluntary Water Quality Management Plans (WQMP).

Production practices will be evaluated for their effect on water quality and producer economics. This includes evaluating tillage practices (no-till & minimum till), herbicide programs (different herbicides with various application rates and methods of application), nutrient management and other similar practices. Special emphasis will be placed on evaluating means of increasing the effectiveness of buffer strips. Effect on water quality will be evaluated on agricultural fields using automatic water sampling devices. In specified sites, gauging stations will provide stream flow and stream samples information. Land use data will be collected and correlated to water quality data to calibrate predictive models for flow volumes and contaminant concentration. Effect on producer economics will be evaluated using basic financial analysis tools such as the MAX program. On-farm trials may be conducted to further investigate new and innovative ideas concerning soil and water conservation. An information & education campaign will be conducted that would include distribution of written material, landowner meetings, conferences, exhibits, field days and tours. Financial incentives will be provided to landowners.

Priority Watersheds include:

1. Mark Twain: Approximately 1.4 million-acre watershed in northeast Missouri. Public drinking water reservoir. Listed as high priority on 303(d) list. Select sub-basins of Mark Twain will be part of this project.
2. Smithville: Approximately 110,000-acre watershed just northeast of Kansas City in northwest Missouri. Ongoing 319 project. Public drinking water reservoir. Listed as high priority on 303(d) list.
3. Monroe City: 617 acre watershed in Monroe City, east central Missouri. Serves public drinking water reservoir.
4. Higginsville: 3,238-acre watershed in west central Missouri. Serves public drinking water reservoir. Listed on 303(d) list.
5. Concordia: 5,145-acre watershed in west central Missouri. Serves public drinking water reservoir.
6. Miami Creek: 80,000 acre watershed in west central Missouri. On-going 319 and SALT project. Serves public drinking water reservoir. Possible listing on 303(d) list.

PRODUCTS AND OBJECTIVES

- Install and operate field level BMP (best management practice) research & monitoring sites in the Monroe City, Mark Twain sub-basin, and Smithville. Additional less comprehensive work may occur in Higginsville, Concordia, Miami Creek and other small watersheds in Missouri. The purpose of these sites will be to compare relative differences in water quality for various BMPs taking into account unique features of each area (soils, topography, etc.).
- Collect land use information for watersheds listed. Information will concern land resources (soils, topography, etc.) and management practices (tillage, herbicides, application methods, rates, nutrients, etc.) and rainfall data.
- Install and operate gauging stations in various streams/rivers in watersheds being studied. Collect flow volume and water samples.
- Conduct laboratory analysis on water collected through field and stream sampling.
- Conduct analysis of the HSPF (Hydrologic Simulation Program Fortran) model (BASINS) or similar models as a tool for use in implementation of the state TMDL program. Calibrate the model with field-level site data, watershed land use data, and stream gauging and sampling information. Compare actual data to output of the model. Continue calibration of the model until a high degree of accuracy is achieved.
- Develop and implement an information/education program. Provide for written material, landowner meetings, conferences, exhibits, field days, and tours.

Project Period: October 1, 1998—September 30, 2003

Sponsor: Environmental Resources Coalition (MCGA)

Funding:

EPA/DNR	$900,000
Nonfederal Match	$600,000

Contact: Missouri Corn Growers Association
P. O. Box 1415
1101 Tanya Lynn Drive

Jefferson City, MO 65102
Peggy Pierson (573) 893-4612

STEWARDSHIP IMPLEMENTATION PROJECT (SIP)

The project will focus on seven reservoirs and watersheds and will be evaluated in the comprehensive study. These include the City of Vandalia reservoir, the Monroe City Route J Lake, the three-reservoir system serving the City of Cameron including Grindstone Lake, Smithville Lake and Salt River Basin of Mark Twain Lake. These lakes are listed by the Missouri Department of Natural Resources on the EPA Clean Water Act Section 303(d) list for the pollutant, Atrazine. The primary cause of this listing has been identified as agricultural non-point source pollution.

PROJECT DESCRIPTION

In 1998, the Watershed Research, Assessment, and Stewardship Program (WRASP) was created. The goal of WRASP is to develop a better understanding of the causes of agricultural runoff and to help local people improve water quality in watersheds across the state. Building upon the successful implementation of WRASP and its programs, the Stewardship Implementation Project (SIP) will begin an implementation phase that will take the knowledge gained and apply it on the ground by working with farmers in their fields. The goal of SIP will be to accelerate implementation of agricultural production practices that increase the level of protection for the environment while maximizing profitability for producers through on-farm crop, conservation, and information management assistance. A specific goal of SIP is that the targeted watersheds be delisted from the Section 303(d) listing.

This project will accomplish its goals through direct one-on-one on-farm technical assistance and through field scale demonstrations of selected production practices, new technologies and management strategies. The program will utilize an Integrated Crop Management (ICM) systems approach to crop production. It will be unique to the specific watershed, field and grower. The program will demonstrate how ICM can improve profitability for the producers while decreasing the potential for pesticide, nutrient and sediment contamination of water runoff. The ICM production system, as utilized in this project, will encompass the best production techniques in terms of pesticide and nutrient management for both agricultural productivity and environmental stewardship. It is recognized that several individual activities and management techniques will comprise the components of the ICM system.

Participating farmers will offer field tours of the side-by-side demonstration sites. These sites will provide in-field comparisons of conventional production systems and a comprehensive ICM system. Key producers in selected watersheds can share the details of their production practices and personal experiences with those in attendance, what was done, why, and how it worked on their farms. Information transfer, grower education and adoption begin here. Each demonstration site will be signed identifying the location as utilizing products, technologies, production practices and ICM systems for their economic and environmental benefits.

OBJECTIVES

1. Identify to the extent possible the areas in watershed with the greatest potential impact on water quality as targets.
2. Establish and maintain working relationships with key producers and in areas targeted for greatest potential impact.
3. Establish and maintain field scale demonstration sites.
4. Data information management and decision support system developed.
5. Data information management and decision support system utilized by demonstration site cooperators.
6. Economic analysis completed on demonstration sites.
7. Field days conducted on demonstration sites.
8. Conduct information/education activities for the watershed.
9. Develop and implement the survey instrument for all landowners within the watersheds.
10. Develop, review, revise and implement water quality monitoring plan for assessing effects of BMP implementation on water quality.
11. Collect and analyze lake-level water samples for pesticide, nutrient, and sediment contamination
12. Collect and analyze stream-level water samples for pesticide, nutrient, and sediment contamination.

PRODUCTS

Water samples will be collected in streams and lakes in the project watersheds. The samples will be analyzed for various contaminants including pesticides, nutrients, and sediment. The sampling plan will not be as rigorous as the original WRASP project whereas the purpose of this sampling will be to document progress made in implementation.

As a component of this project, a survey instrument will be developed. This survey will measure the extent by which practices being promoted by the project are being adopted by the producers in the watersheds. The survey will estimate adoption of the pesticide, nutrient, and sediment management practices. The survey will be conducted throughout the project in order to access progress on an on-going basis. The Soil and Water Conservation Districts in the targeted watersheds will be asked how many acres they have enrolled in integrated pest management and nutrient management planning cost-share programs to measure adoption and implementation trends.

Project Period: May 1, 2002—April 30, 2005

Sponsor: Environmental Resources Coalition

Funding:	EPA/DNR	$200,000
	Nonfederal Match	$135,000

Contact: Environmental Resources Coalition
3118 Emerald Lane
Jefferson City, MO 65109
Steve Taylor (573)-893-4181

Pilot Agricultural Nonpoint Source SALT Projects

Overview of the Program
Provided by funding through the 1/10th of 1% Parks and Soils Sales Tax of Missouri, the Agricultural Nonpoint Source Special Area Land Treatment (AgNPS SALT) program is offered through the Missouri Department of Natural Resource's Soil and Water Conservation Program.

The program allows local county Soil and Water Conservation Districts (SWCD) to direct technical and financial assistance to landowners with land identified and prioritized as having water quality impairments that address agricultural nonpoint source pollution problems. Success of these projects is dependent on the cooperation of numerous partners using a variety of tools to accomplish project goals.

> The mission of the AgNPS SALT program is to "improve, protect and maintain the water quality of the State of Missouri through the prevention and reduction of agricultural nonpoint source pollution using a watershed-based approach".

Goals of the AgNPS SALT projects include, but are not limited to:
- reducing pesticide and nutrient runoff from cropland,
- improving pasture management,
- reducing soil erosion off agricultural land,
- improving animal waste management,
- protecting and enhancing riparian corridors, and
- raising awareness of agricultural nonpoint source water pollution issues.

Project Details

- Projects should target watersheds between 20,000 to 60,000 acres.
- $750,000 is the maximum amount of funding available per project.
- Projects must be 5, 6, or 7 years in length.
- Watershed must be a complete topographic watershed, subwatershed, or 14-digit HUC.
- Priority is given to projects that address waters on the 303(d) list or Unified Watershed Assessment.
- Any practice or incentive used in the AgNPS SALT projects must provide demonstrated water quality benefits.

Eligible Practices and Incentives
The eligible practices and incentives offered in AgNPS SALT projects are for the primary purpose of improving or restoring water quality on agricultural lands throughout the state of Missouri. When properly implemented and certified by the NRCS or MDC, landowners receive up to 75% in cost-share funding for these practices. Incentives are also available to landowners for removing land from production to implement specific practices offered in the program. Also,

incentives are available for proper management techniques to lesson the impacts of production agriculture on water quality. Contact your local soil and water conservation district to inquire about the practices and incentives available to you.

Application Approval

All final applications submitted by the deadline will be reviewed and ranked by the AgNPS SALT Review Committee, a committee consisting of agricultural and natural resource professionals. Once reviewed, the applications are presented to the Soil and Water Conservation Districts Commission for approval. Districts whose projects are awarded final approval will begin implementation on July 1 of the fiscal year.

Partners

Partners can greatly contribute to the success of an AgNPS SALT project and are an essential element in success of these projects. Participation may be in the form of financial contributions, technical assistance, publicity, sponsorship or other types of support.
Examples of partners may include but are not limited to:

- Missouri Natural Resource Conservation Service (NRCS)
- Missouri Department of Conservation (MDC)
- Missouri University Outreach and Extension (UOE)
- Farm Service Agency (FSA) Missouri Department of Natural Resources
- Water Pollution Control Program (WPCP)
- Regional offices
- United States Fish and Wildlife Service (USFWS)
- Ducks Unlimited (DU)
- Quail Unlimited (QU)
- County Commission
- Local soil and water conservation districts (SWCDs)
- Local agri-businesses
- Local newspapers
- Local schools

Program Status

Currently, there are 39 AgNPS SALT projects throughout the state of Missouri. Since the onset of the SALT program, there have been four calls for AgNPS SALT projects. The first call (also known as the first pilots) has twelve projects, the second call has nine projects, the third call has eight projects, the fourth call has 11 projects and the fifth call is currently in the application process. These projects encompass watersheds averaging 50,000 acres in size as portrayed in our map of AgNPS SALT projects.

The Soil and Water Districts Commission *plan for the future* including approving 10-12 more projects each fiscal year. It is anticipated by 2005 there will be 66-68 total AgNPS SALT projects approved since 1997. With the additional money through EQIP, some of the local Soil and Water Districts may use the SALT grant for additional technical assistance to focus on implementation BMPs through the use of EQIP dollars in priority watersheds.

Pilot AgNPS SALT projects propose to address diverse water quality issues associated with production agriculture. Restoration efforts in pilot projects represent a cross section of water quality issues facing Missouri's agricultural industry today.

For more detailed information on the 39 AgNPS SALT projects, a brief description of each project can be located on the internet at http://www.dnr.state.mo.us/wpscd/swcp/swcpsalt.htm. It is the intention of the program to issue a call for AgNPS SALT projects each year pending availability of funds.

TERM DEFINITIONS:

Best Management Practices (BMPs): Agricultural "Best Management Practices" for pollution control are management practices and structural measures which are determined to be the most effective, practicable means of controlling and preventing pollution from agricultural activities. BMPs are singular practices that, when put together in combination with other practices, will reduce soil erosion, nutrient and pesticide runoff or leaching, and manage animal manure. BMPs are actions taken by each individual agricultural operation to protect water quality while achieving production.

Resource Management System (RMS): combines management and conservation practices that, when installed, will prevent degradation and permit sustained use of the natural resources (soil, water, air, plants, animals) by meeting specific quality criteria.

Integrated Crop Management (ICM): A comprehensive system that involves considering the environment when selecting pesticides and nutrients. ICM emphasizes a more comprehensive systems approach toward agricultural production systems rather than concentrating on the benefits of individual practices. ICM is an informed decision-making process that takes into account production practices, economics, soil and water quality, and nutrient and pest management.

Tolerable Soil Loss value ("T"): The amount of soil loss that can be tolerated each year while still maintaining high soil productivity.

APPENDIX J

Implementation Assistance

IMPLEMENTATION ASSISTANCE

The agencies and programs, which follow, are some of those that may be part of NPS program implementation in Missouri. The list is not intended to be either exclusive or all-inclusive. Included are existing requirements of other federal and state laws to the extent they are relevant. Addresses and telephone numbers are provided at the end of this section to obtain additional information on listed programs.

Department of Natural Resources

Water Protection & Soil Conservation Division

Soil and Water Conservation Program

The Soil and Water Conservation Program (SWCP) provides staff support for the Soil and Water Districts Commission. Program activities are supported by one half of the proceeds of a one-tenth of a percent Parks and Soils sales tax in Missouri. The other half is used to maintain the state's park system. In 1984 an amendment to the constitution of Missouri, Article IV, Section 47 (a)-(c) authorized the collection of the sales tax. The soils tax programs, which operate under the authority of RSMo 278, have been in place since 1986. More than 78 percent of the soils tax goes to landowners for soil conservation.

Grants to Districts: Each of the 114 soil and water conservation districts receives grants for their operation. Uses are determined by each locally elected board and include funding for management, clerical and technical personnel; information and education programs; equipment and general administrative expenses. The districts serve as the delivery system for the state's voluntary incentive programs and other soil and water conservation efforts.

Cost-share Program: Landowners are reimbursed for installing practices that prevent or control excessive erosion on agricultural land. The practices are designed to reduce soil erosion, maintain agricultural productivity and prevent degradation of water quality in rivers and streams. Landowners must invest 25 percent or more in their projects. Practices and reimbursement rates generally complement those of USDA with some exceptions.

Loan Interest-share Program: Landowners are reimbursed for a portion of the interest paid on private loans used to finance standard soil erosion control practices or the purchase of limited tillage conservation equipment. This program is being expanded to promote total resource management for agricultural land.

Research Grants: Grants are awarded to Missouri state colleges and universities for research projects to support the goals of the Soil and Water Districts Commission. Subjects vary from agronomic to sociological as they pertain to effective conservation practices.

Soil Survey: Staff provide assistance to accelerate the completion of the state's soil survey. Soil surveys are fundamental in natural resource documentation, planning and management as they identify specific soil types on the landscape. Field mapping for the initial inventory was completed in 2002.

Special Area Land Treatment (SALT) Program: Participants in specially designated watersheds use a combination of cost-share, loan interest-share and project grants to address soil and water conservation problems specific to that identified area and to carry out total resource management on their farms. The SALT program has already begun to expand to control pollution caused by sedimentation and chemical runoff from agricultural land.

Water Pollution Control Program

The Water Pollution Control Program (WPCP) derives its authority from the Missouri Clean Water Law, Sections 644.006 through 644.141 RSMo, and provides staff support to the Clean Water Commission (CWC). Administrative rules promulgated under the Clean Water Law may be found in 10 CSR 20. Section 644.021 (1) RSMo designates the CWC and the water pollution control agency for the state, and 644.136 further designates the CWC as the water pollution agency for purposes of administering federal water pollution control acts.

The Clean Water Law, 644.051 RSMo specifically lists prohibited acts.

1. Causing pollution of any waters of the state. Placing, causing or permitting any water contaminant to be placed where it is reasonably certain to cause pollution of any waters of the state;

2. Discharging any water contaminants into any waters of the state that reduce the quality of such waters below water quality standards.

DNR has the authority to conduct investigations concerning violations of the Clean Water Law. Section 644.056 RSMo requires the department to cause investigations to be made upon request of the commission or upon receipt of information concerning alleged violations of the Clean Water Law, any standards, limitations, orders, rules or regulations promulgated pursuant to the law. Investigations may be conducted as deemed advisable by the department. DNR has the authority to attempt to eliminate violations through conference, conciliation or persuasion. Failing this or in order to immediately halt endangerment to the health or welfare of persons, DNR may order abatement or file an abatement complaint with the commission.

Section 644.076 RSMo allows the CWC or DNR to institute a civil action for injunctive relief to prevent violation and allows for the assessment of penalties. The attorney general or local prosecuting attorney may take action. This section also sets penalties for falsifying any documentation required by the Clean Water Law and for willful or negligent violation of the law.

In addition to the above penalties, Section 644.096 RSMo allows DNR to collect actual damage costs. These may include all costs and expenses necessary to establish and collect such costs,

and the costs and expenses of restoring any waters of the State to their condition prior to the violation.

Animal waste permits and LOAs: DNR has regulatory authority over Animal Feeding Operations (AFOs), 10 CSR 20-6.300. Letters of Approval (LOAs) and construction or operating permits can be obtained for AFOs from the department based upon the total animal units proposed at a facility. Class II and smaller facilities are allowed to obtain a LOA on a voluntary basis (Class II = 300-999 animal units). Class IC (1,000-2,999 animal units), IB (3,000-6,999 animal units), and IA (>7,000 animal units) facilities are all required to obtain construction permits, 10 CSR 20-6.300. All construction permit applications require a fee of $500. Operating approvals and permits require a professional engineer's certification of structures by presenting a signature and seal on the application form. General operating permits are available for Class IC and IB facilities for $150 for up to five years. Site-specific operating permits for Class IA facilities are $3,500 per year.

Under 10 CSR 20.010-030 operators of Class IA Concentrated Animal Feeding Operations (CAFOs) are required to be certified by the department. The rule defines certification requirements, personnel who must be certified, level of certification required, and sets fees for certification and renewals.

State Revolving Fund: Section 644.122 RSMo allows the state to provide low interest loans to public entities for planning, design and construction of water and wastewater treatment facilities. The program is a cooperative effort of the US Environmental Protection Agency (EPA), WPCP, the Clean Water Commission and the Environmental Improvement and Energy Resources Authority. The loans provide financing at below market rates for 100 percent of the eligible cost of wastewater treatment and conveyance systems. At present, interest is approximately one third of the market rate of municipal bonds. Loans are made for up to 20 years.

Animal Waste Treatment System Loan Program: The Animal Waste Treatment Loan Program is a cooperative venture of the Missouri Departments of Agriculture and Natural Resources, WPCP, EPA, CWC and Missouri Agricultural and Small Business Development Authority (MASBDA), which administers the program. It is authorized in 644.122 RSMo, and funded through the Missouri State Revolving Fund from the sale of water pollution control bonds and federal capitalization grants. MASBDA's administrative authority is found in 348.220 RSMo.

The program is designed to finance animal waste treatment systems for independent livestock and poultry producers at interest rates below market levels. Loans may be used to finance waste management structures and equipment approved as part of a DNR LOA for an animal waste management system. Borrowers must not exceed the 1,000 animal unit limit. Loans can finance up to 100 percent of system cost, minus any federal or state cost-share assistance, and may be made for up to ten years.

Storm Water Permits: Under state regulations passed in August 1992, a Missouri State Operating Permit is required for storm water runoff from certain industrial sites, construction sites, and

urban storm sewers (10 CSR 20-6.200). Most of these facilities are issued a general permit, which is written to cover a broad category of pollutant sources. General permits may use a combination of management practices, monitoring, and effluent limits to manage the pollutants.

Site-specific permits for storm water discharges are written when a general permit is not available for the activity; when the facility is a significant contributor of pollutants based upon such factors as proximity to sensitive waters, size of discharge, or nature of pollutants; or when the facility is not in compliance with its general permit. Site-specific permits will include a combination of management practices, monitoring requirements, and effluent limits based upon best available technology and water quality goals.

Secondary Containment: The department requires by rule, 10 CSR 20-8.500, that facilities which store, mix, apply, or repackage bulk agrichemicals (fertilizers and pesticides) for more than thirty consecutive days in a year, must have appropriately designed secondary containment facilities to prevent a release of chemicals into waters of the state. These secondary containment facilities must obtain a construction permit from the department before construction and subsequently an operating permit. Secondary containment facilities consist of protective walls or dikes around bulk storage tanks to contain spills, concrete pads under loading areas to facilitate the collection of spilled product and residue from cleaning of equipment, and provisions for proper management of rinsates generated during application equipment cleaning and use.

Nonpoint Source Pollution Management Program: This program is authorized and funded under Section 319 of the Clean Water Act. The NPS Management Program is an integrated approach that develops and coordinates nonpoint source activities with federal, state, local and private sector entities in information, education, demonstration, technical assistance, and implementation assistance.

Public Drinking Water Program

Authority for the Public Drinking Water Program (PDWP) is derived from the Missouri Safe Drinking Water Act, Section 640.100 through 640.140 RSMo with rules in 10 CSR 60. The program supervises the design, construction and maintenance of public water systems (PWS). Perhaps the most important function of the program, from a NPS perspective, is the requirement for monitoring for water contamination, publication of the monitoring results and establishment of maximum contaminant levels allowed in drinking water.

Drinking Water Monitoring Data: Section 640.120 RSMo requires monitoring for contaminants 1) as listed in state drinking water regulations, 2) included in the national primary drinking water regulations, 3) required under the federal Safe Drinking Water Act or 4) which DNR finds may be hazardous to public health. Specific contaminants and their maximum contaminant levels (MCLs) are found in 10 CSR 60-4.020 through 4.110. General classifications of contaminants are microbiological contaminants; inorganic chemicals; synthetic organic chemicals, which includes some pesticides; trihalomethanes; unregulated chemicals; and special volatile organic chemicals. Section 640.130 RSMo allows DNR to issue notification and abatement orders when it has been determined that an emergency condition exists which endangers or could be expected

to endanger public health. Ambient water quality in drinking water supply reservoirs is not directly monitored. Drinking water is tested after treatment. However, the data is a useful tool and will show water quality standards violations in many instances.

In instances where PWSs are not in compliance with the MCL for particular contaminants, DNR, under 10 CSR 60-6.020 (1) of the Missouri Public Drinking Water Regulations, may after public hearing, grant an exemption from a MCL requirement. The department is required to provide to the PWS a schedule of compliance for each MCL requirement covered by the exemption. The compliance schedule contains conditions the department may prescribe and steps and timetable to move back into compliance. When the contaminant(s) is/are the result of agricultural activities, exemption conditions include a requirement to "work with Natural Resources Conservation Service, University Extension, Department of Agriculture, area farmers, and others in evaluating and implementing watershed protection measures and best management practices..." Watershed protection is a high priority for public water supplies and receives even more emphasis under the new Safe Drinking Water Act of 1996.

Source Water Protection Program: The Safe Drinking Water Act of 1996 (SDWA) requires states interested in flexible monitoring opportunities to delineate and assess drinking water source water areas throughout the state. States may also set up a Source Water Protection Program (SWPP). The steps involved in developing a SWPP include: 1) Inventory and characterize public drinking water sources; 2) Identify pollutant sources and relative impact; 3) Assess vulnerability of intake to contaminants; 4) Establish source water protection goals; 5) Implement the program; and 6) Monitor and evaluate program effectiveness. Through this program the PWS or any local government entity can petition the PDWP for approval to set up a local, voluntary partnership with any affected persons and organizations to protect the drinking water supply from contamination. EPA approval for Missouri's Source Water Protection Program is pending.

The NPS program and the SWPP can complement one another very effectively. For example, section 319 funding may be used for some assessment activities. In addition, the assessments developed for the NPS program can provide information and data about pollution sources which may contribute to contamination of public drinking water supplies and identify surface waters known or suspected of being contaminated by nonpoint source pollution. Conversely, the SWPP can provide information and data from source water assessments that could help expand coverage of state water quality assessments. Source water assessments may provide additional data upon which to base 303(d) listing decisions and also to develop TMDLs for a particular water body. Nonpoint source staff involved with TMDL studies are working closely with staff in the PDWP to share assessment data in an effort to reduce duplication.

The SDWA provides funding for a drinking water state revolving fund for low interest loans to public water systems for capital improvements (planning, design and construction of water plants, tanks, water lines, etc.). After the source water protection programs established by the SDWA are implemented, there may also be opportunities for loans from this fund to be used for source water protection activities.

Vulnerability Assessments: Federal regulations (40 CFR 141-143) require public water systems to perform baseline monitoring for all the chemical contaminants listed in the regulations. Some of the most common synthetic organic contaminants (SOCs) for which testing is required are pesticides; analyses are very expensive. If it can be determined that a selected chemical is not used, stored, disposed, manufactured or transported within one half mile of a public well or within a drinking water impoundment's watershed, then a monitoring waiver may be granted to that system for the specific chemical, thus reducing that monitoring requirement.

Missouri has issued waivers by performing vulnerability assessments on every public water supply system. A geographic information system (GIS) is used to record the location of all public wells and surface water intakes. Characteristics of the wells or watershed are recorded, as are sources of SOCs. A routine search of over 100 databases is executed every quarter to locate new sites where SOCs have been used, stored, transported, or disposed. The GIS can analyze which water supplies are vulnerable based on proximity of contaminant sources. Secondary considerations utilized to determine susceptibility include well construction, geology, overlying soil types, direction of groundwater flow, characteristics of contaminants and others. If a source of contamination is located within one-half mile of a well (450 wells out of 2000 total have been identified as vulnerable) or within the watershed of a surface water supply, that water source is considered vulnerable, and testing is required.

Air and Land Reclamation Division

The Land Reclamation Program (LRP) derives its authority from the Land Reclamation Commission, Sections 444.350 through 444.970 RSMo, and provides staff support to the Land Reclamation Commission. The U.S. Congress enacted Public Law 95-87, the Surface Mining Control and Reclamation Act of 1977, which regulates surface coal mining operations. It established a program and funding for reclaiming abandoned coal mine lands that were disturbed prior to August 3, 1977. The Land Reclamation Program obtained primacy to carry out the provisions of Public Law 95-87 from the Office of Surface Mining in 1981. The Land Reclamation Program also regulates industrial minerals and metallic minerals.

Surface Coal Mining: The Land Reclamation Program is responsible for regulating active coal mining activities within the state as outlined in Sections 444.800 through 444.970. Primary goals are to assure that surface coal mining is conducted in a manner to minimize or prevent adverse effects to the citizens of the state and the environment. The program is responsible for assuring that sedimentation and discharges from mining sites comply with NPDES requirements.

Industrial Minerals Mining: The Land Reclamation Program is responsible for regulating activities associated with the mining of clay, limestone, sand, gravel, barite and tar sands as outlined in Sections 444.500 through 444.789. Primary goals are to assure that the mining of these commodities is conducted in a manner to minimize or prevent adverse effects to the citizens of the state and the environment.

Metallic Minerals Mining: The Land Reclamation Program is responsible for regulating activities from the handling and disposal of waste associated with the mining, benefication, and

primary smelting of minerals or mineral ores containing lead, iron, zinc, silver and gold as outlined in Sections 444.350 through 444.380 RSMo. The primary goal is to assure that metallic mineral wastes are disposed of properly to minimize or prevent adverse effects to the citizens of the state and the environment. All operations associated with the mining of metallic minerals are required to obtain an NPDES permit.

Abandoned Mine Lands: The Land Reclamation Program is responsible for reclaiming mined lands presenting health and safety problems associated with coal mining that occurred prior to August 3, 1977, as outlined in Sections 444.810 through 444.940. Priority for reclamation of past coal-mined lands is based on classification of 1) the protection of public health and safety from extreme danger (e.g., high walls and open shafts), and 2) the protection of public health and safety not constituting extreme danger, and 3) restoration of land and water previously degraded.

Reclamation is funded by a federal tax on coal. The U.S. Office of Surface Mining Reclamation and Enforcement collects from producing coal companies 35 cents a ton on surface mined coal and 15 cents a ton for coal mined underground. Money is deposited into the Abandoned Mine Land Reclamation Fund and dispersed through grants to states. Declining coal production has resulted in decreased allocations; therefore, Congress has included a minimum base funding amount for states with limited coal production to continue their reclamation programs. Language is included in the federal appropriation which allows AML funds made available to states to be used as non-federal match for programs related to the treatment or abatement of acid mine drainage.

Most abandoned mine lands in Missouri do not require reclamation and provide wildlife habitat and recreational opportunities. DNR offers technical assistance to owners of abandoned coal mine lands. Staff personnel can provide expertise in soils, revegetation and water quality. Such assistance includes literature, workshops and onsite visits with landowners to discuss their problems and improve revegetation and water quality on their property.

Environmental Assistance Office

DNR established the Environmental Assistance Office to provide services that can be described as information, education, training and assistance. The program serves owners and employees of businesses, agricultural operations, elected officials, local governments, teachers and the general public. Its primary function is to help people understand and comply with environmental statutes and regulations.

Pollution Prevention: This unit works to protect the environment by encouraging pollution prevention. Sometimes referred to as waste minimization or waste reduction, it is the use of materials, processes and practices that reduce or eliminate the creation of pollutants at the source. The unit provides pollution prevention information and assistance, training and presentations, informational materials and coordination with other DNR staff.

Environmental Education: The Environmental Education Unit's objective is to promote environmental literacy of Missourians by providing knowledge to effectively solve existing environmental problems, prevent new ones, and maintain a sustainable environment. Unit focus is upon in-service training for teachers, providing graduate-level college courses on environmental issues. Unit staff coordinate the production and collection of educational materials within the Division of Environmental Quality and distribute these materials.

Operator Certification and Training: This unit has two primary duties: certification of and providing training for water supply and wastewater operators. The unit has developed a statewide training plan for operators identifying what training is provided, and where it can be obtained, areas of training which are insufficient, and how those needs can be addressed. The unit publishes a bimonthly newsletter for certified operators, "Water and Wastewater Digest," to provide updates on training courses, changes in regulations, etc.

Business Assistance: The unit provides guidance to businesses to help them understand and comply with environmental regulations, obtain permits, access governmental information sources, and incorporate pollution prevention concepts into their operations. Unit staff provide technical assistance to businesses with emissions inventories as required in the Clean Air Act Amendments of 1990. It also maintains the Toxics Release Inventory database.

Local Government Assistance: Guidance is provided to communities with operator assistance and facilities troubleshooting, voluntary assessment of wastewater systems, individualized in-depth community assistance with cross-media environmental issues and project financing.

Agricultural Assistance: Staff assist farm operators and agribusiness in understanding and complying with environmental regulations and applying pollution prevention concepts, and conducts outreach efforts such as displays, presentations and workshops.

Information Service: EAO's information service staff provide Missouri citizens a direct link with DNR through a toll-free number. Individuals can promptly access professionals who can respond to environmental questions, complaints or concerns. EAO can provide many division publications and materials upon request.

GEOLOGICAL SURVEY AND RESOURCE ASSESSMENT DIVISION

Within DNR is the Geological Survey and Resource Assessment Division (GSRAD) which, through the Oil and Gas Council, has regulatory authority over potential use and development of Missouri's oil and gas resources (including exploration drill hole construction, abandonment and plugging), dams, and water resources. In accordance with 256.110 RSMo, the state geologist (division director) is authorized to cooperate with federal and state agencies and to enter into formal cooperative agreements. Section 256.050 RSMo gives GSRAD the responsibility for determining positions, formations, arrangements, composition and utilization of both surface and ground water. This section also requires the publication of appropriate reports of work completed and educational bulletins on geology, water and well construction.

Water Resources Program (WRP)
The State Water Plan, authorized under the Missouri Water Resources Law (640.400 through 640.435 RSMo) must prepare and periodically update a state water plan that assesses the state water resources. Technical publications on drought response planning, flood analyses, information directories and future public interaction help with informing the public and assisting future policy makers with the information they need to make the best decisions for the prudent use and protection of water resources. A seven volume technical water resource characterization study and six regional reports of functional water use problems and opportunities are being produced. Use of an interagency task force is mandated to provide direction for the plan. The task force is made up of the Missouri Departments of Agriculture, Conservation and Health; the University of Missouri College of Agriculture, Food, and Natural Resources; and other agencies and departments as appropriate.

Water Resources maintains records submitted by public water well drillers. The primary information about a well is contained in a driller's log, which is defined in Section 256.603(4). The log contains information such as depth, volume, and geologic strata encountered. When information from drillers' logs are linked together, a picture of geological conditions and ground water are obtained. This allows experts to predict where water supplies can be impacted by surface activities and assists in siting potential impact sources such as CAFOs in order to protect groundwater, springs and water supplies.

The Major Water Use Registration data files maintained in the program contain on a statewide basis the spatial location, intended use, quantity withdrawn, and source of water for those users who have the daily capacity to pump 100,000 gallons or more.

The WRP also provides technical assistance with stream erosion, deposition, surface water flooding, drought impacts, location and health of wetland resources, contributing areas for springs and wells, groundwater level monitoring and additional studies that are used to determine water movement and predictions of ground and surface water flow. Image processing and digital data analyses are used to determine contributing watersheds, streams, groundwater aquifers, wetlands and lakes for mapping. Data layers are analyzed using ARC-INFO, ARC-View and PCI Satellite Imaging. These projects can show, and in the future will assist in, analyzing nonpoint source impacts upon the land, water and groundwater sources.

Under Section 640.418(1) RSMo special water quality protection areas may be established. Designation of these areas is related to exceedence of maximum contaminant levels (MCLs) in a public water system. DNR must consider the probable effects of the contamination on human health and the environment, duration of contamination, quality, quantity and use of the water, and effectiveness of protective measures.

Geological Survey Program
The Program has developed an Aquifer Classification System. The system regionalizes aquifers into areas according to their susceptibility to contamination. Areas were defined using

hydrologic and geologic parameters of shallow bedrock or surficial deposits, aquifer recharge potential, presence or absence of an aquiclude, and the natural or current ground water quality. Losing stream demarcations determine where a surface to groundwater exchange is likely to occur. Designations are intended to protect groundwater.

One of the more important areas regulated by DGLS is that of water well drillers. Section 256.600 through 256.640 RSMo is titled the Water Well Driller's Act. Subsequent regulations are found in 10 CSR 23. Those who drill wells for water use, monitoring, or exploration holes wells are required to obtain a permit from DGLS. Regulations specify construction and plugging standards for well drillers and landowners. Considerations include drainage patterns, elevation, sanitation and pollution prevention. Also specified are distances from pollution or contamination sources such as chemical and fertilizer storage areas, manure storage areas and septic tanks. The Act also requires that water (dye) tracing must be registered and traces reported.

As a part of overall protection of ground water, 10 CSR 23-3.020 discusses maintenance and repair of wells and abandonment of wells. It delineates steps to be taken when a well is to be abandoned. Abandoned wells attached to a structure or on site must be plugged prior to connection with a public water supply in order to prevent cross contamination.

10 CSR 23-3.030 and 10 CSR 23-3.070 contain standards for well construction. These include specifications for well casings, minimum depths, grouting, etc. In addition, specific, regionalized standards are mapped in 10 CSR 23-3.090.

Missouri Department of Agriculture

Bureau of Pesticide Control

Pesticides: The Missouri Department of Agriculture (MDA) is the state lead agency for pesticide regulation and control. Generally, that responsibility may be divided into three areas: enforcement of laws relating to the use and misuse of pesticides; the certification and licensure of pesticide applicators and dealers; and the registration of pesticides in Missouri. MDA has primacy for pesticide enforcement and the ability to certify pesticide applicators under authority of the Federal Insecticide, Fungicide and Rodenticide Act (FIFRA).

All pesticides sold in Missouri must be registered with MDA. Conditions for registration are found in the Missouri Pesticide Registration Act, 281.210-310 RSMo. MDA will pursue additional legal authority as deemed necessary to protect Missouri water resources from pesticide contamination.

Section 281.070 RSMo grants MDA the authority to investigate the use of pesticides. Investigations are conducted in response to complaints or when violations of the statutes or rules are identified during inspections. As defined in 281.020 RSMo, “use” is mixing, applying, storing or disposing of a pesticide. Misuse is “a use of any registered pesticide in a manner inconsistent with its labeling...”. When violations are identified, civil and/or criminal penalties

(281.060 and 281.1-5 RSMo respectively) may be issued against responsible individuals.

MDA conducts inspections of pesticide manufacturers to assure that pesticides are properly registered, labeled and packaged. Formulation verification samples are collected and records are monitored in accordance with EPA criteria. Inspections of retail outlets are made to ensure that only pesticide products properly registered for use in Missouri are being offered for sale.

Section 281.025 RSMo gives MDA the authority to issue regulations. These regulations may prescribe application methods and the amounts and concentrations of pesticides used. Also, they may restrict or prohibit pesticide use in certain areas during specified periods of time when deemed necessary to prevent damage or injury. A pesticide's use may be restricted if unreasonable adverse effects to the environment or public health result from its use. In determining the need for regulations, consideration will be given to pertinent research findings, and recommendations of other Missouri agencies, the federal government, and other reliable sources.

MDA certifies pesticide applicators and licenses pesticide dealers who sell restricted-use pesticides to the end user. Through University Extension MDA offers training to pesticide applicators and certifies all noncommercial applicators, private applicators and public operators who use restricted-use pesticides and all commercial applicators using pesticides. Licenses are required for pesticide technicians working in ornamental and turf, general structural and termite pest control categories. The purpose is to educate and set a level of competency so applicators and technicians are familiar with the human and environmental hazards associated with pesticide use.

The pesticide applicator certification program is managed by the MDA under statutory authority provided by the Missouri Pesticide Registration Act 281.210-282.310, RSMo (Cum. Spp. 1993), and the Missouri Pesticide Use Act 281.005-281.115 RSMo (1994). Its provisions attempt to ensure that pesticide use be both limited and controlled as follows: limit use to (1) appropriate concentrations, (2) approved uses, and (3) application by trained persons. Generally, these specifications are itemized on the pesticide label. The Cooperative Extension Service provides training with participation from DNR.

Missouri Department of Conservation

The Missouri Department of Conservation (MDC) has designated authority to manage the fish, forestry, and wildlife resources of the state. The department's principal sources of revenue are receipts from the sale of hunting and fishing permits and the one-eighth of one percent conservation sales tax. Funds are also received through Federal legislation from user taxes on sales of hunting and fishing equipment apportioned based on state hunting and fishing license sales. Other funding is received under provisions of the Endangered Species Act and from one-time grants and contracts.

MDC makes available funding for three cost-share programs administered by the DNR's Soil and Water Conservation Program.

- The Wetland Heritage Program is funded jointly by MDC and the US Fish and Wildlife Service. Program objectives are providing fish and wildlife habitat, restoring native wetland vegetation, and developing and protecting riparian zones when wetlands are restored or created adjacent to rivers and streams.

- An additional 25 percent cost-share is available to landowners for seeding Conservation Reserve Program acres. The addition is designed to encourage more producers to enter land into the program and encourage planting those mixtures that have greater wildlife benefits.

- An additional 25 percent cost-share is available to landowners for wetland restoration on Wetland Reserve Program easement acres up to $50 per acre.

Agricultural Liaison: The agricultural liaison program is designed to counter declining wildlife habitat conditions on private land and involves working with state, federal and private entities which deal with agriculture. The program encourages awareness of the effect of farm practices on natural resources and development of farming systems beneficial to fish, forests and wildlife.

Fisheries Division
The Fisheries Division is responsible for the long-term survival of native aquatic plants, animals and habitats.

Stream Incentive Program: The Stream Incentive Program has three facets: The stream/watershed restoration project addresses stream-related watershed problems by encouraging willing landowners to protect and use their streams wisely. It provides cost-share incentives to help landowners keep livestock out of streams and ponds, control stream-bank erosion and improve fish and wildlife habitat.

Alternative Watering Sources for Planned Grazing Systems provides cost-share assistance to help landowners install alternative watering systems for livestock instead of using streams for watering. Eligible systems include mechanical and solar watering devices that provide water to livestock away from streams.

Stream Stewardship Agreements are for landowners that already have shown their dedication to long-term protection of healthy stream corridors. Landowners submit written bids for per-acre payments, and the MDC pays landowners cash over a ten-year period if they protect and manage stream-side property under a stream management plan and assure continued protection through a conservation easement. Stream Stewardship agreements are available only on priority streams. Fisheries district supervisors rank each stream based on resources in their areas. These may include smallmouth bass, endangered species, trout or recreational uses.

Streams for the Future: The Stream Incentive Program's roots extend back to the Streams for the

Future initiative. Goals were to involve Missouri citizens in stream stewardship, improve fish and wildlife habitat along streams and help landowners use conservation-wise practices to protect stream resources.

Among programs developed to meet those goals was the Missouri Stream Team, an adopt-a-stream program sponsored by the Missouri Conservation Federation, MDC and DNR. Stream Teams pick up litter, plant trees, install fish habitat structures, bring information about stream conservation into classrooms, or take training to monitor stream water quality. The Volunteer Water Quality Monitoring Program is an extension of the Stream Team program offered to interested teams and team members. It provides various levels of training to allow citizens to monitor the physical, chemical, and biological aspects of streams.

MDC also provides technical advice and material assistance for stream-improvement projects. It maintains demonstration areas where landowners can see stream conservation in practice and can provide brochures that explain how to deal with common stream problems. Management biologists provide management advice and technical assistance to private landowners with lake or stream problems, stream erosion and habitat concerns, and provide technical assistance to state and federal agencies, local governments and public utilities.

Forestry Division

The Forestry Division is responsible for management and protection of the state's forest resources. Major objectives are rural fire protection, promotion of sustainable forests, research to improve forest management and biodiversity, sustainable management and protection of public lands, and cooperation with public and private agencies in disease and insect control.

Agroforestry Program: The Missouri Economic Diversification and Afforestation Act of 1990 (as amended, 1993) established the Agroforestry Program. It directed MDC to develop and implement the program in cooperation with several other organizations. Agroforestry is the practice of planting or establishing rows of trees or shrubs bordered on each side by a narrow strip of ground cover, alternated with wider strips of row crops, grass or other crops. The intent is to provide state rental payments on Conservation Reserve Program (CRP) lands for an additional ten-year period after the federal contract expires, if those lands are used for agroforestry purposes. The program also allows participation on lands not enrolled in CRP. Due to budget constraints, no new sign-ups are being accepted for this program.

The program provides annual incentive payments that can be combined with other income from the land to produce income substantially equal to the previous CRP payment. Financial assistance to share the cost (up to 75 percent) is provided to establish trees and/or shrubs to be used in the program.

Agroforestry allows cropping systems using trees and row crops, forage crops, alternative crops and horticulture crops. Benefits include reduced erosion, buffer/filter strips, riparian protection, increased biodiversity, nutrient retrieval and opportunities for use of small acreages and niche markets.

Technical Assistance: Through a cooperative program with the US Forest Service, technical assistance is provided to private woodland owners. Service includes tree selection, planting advice, forest management recommendations, forest product utilization and market assistance, and wildlife management recommendations. Tree planting plans are prepared for qualifying communities to assist with plantings on public lands. Assistance is provided to forest product manufacturers and forest landowners on resource availability, market information, new technologies, manufacturing efficiency and training. Individual businesses are encouraged to improve utilization and reduce output of residues through environmentally acceptable manufacturing methods.

Forest Cropland: Under terms of the State Forestry Act, passed by the General Assembly in 1946, land classified as forest cropland is eligible for a partial tax deferment. A number of conditions apply, and the owner must agree to follow basic forest management requirements designed to keep the land in permanent forest production.

Wildlife Division

The Wildlife Division is responsible for programs related to wildlife resources of the state including management of 363 conservation areas. Field staff provide a range of technical assistance to private landowners and annually develop 400-500 management plans for new cooperators. The division operates two demonstration farms, trains Natural Resources Conservation Staff in wildlife management principles and has staff wildlife biologists assigned to all Missouri NRCS offices. Wildlife restorations are conducted with species such as ring-necked pheasants, prairie chickens, osprey and assisting other states in wild turkey restoration.

The division conducts research in all phases of wildlife management with an emphasis on long-term ecosystem studies. Approximately five cooperative studies on agricultural topics affecting wildlife are underway annually.

Outreach and Education Division

The Outreach and Education Division informs the public about Missouri's forest, fish and wildlife, and works to involve people in conservation activities and outdoor recreation. It uses a wide range of mass communications tools including a 400,000+ circulation monthly magazine, weekly news packet, TV and radio programs, Internet website, and a variety of audio, video, book and print publications.

Schools and young people receive special attention through grade-targeted curriculum materials, visual aids, lesson plans, and teacher workshops. These are coordinated through a team of field-based consultants who regularly visit schools and work closely with teachers and administrators.

Face-to-face service to the general public is provided through the division's four nature centers, metropolitan offices, ombudsman's office, exhibits and others. These units provide both programs and personal contact, answering questions and providing general background material on conservation.

Missouri Department of Health and Senior Services

The Missouri Department of Health and Senior Services (MDHSS) directs and manages public health functions and programs in the state, (192.005 RSMo). In accordance with Section 192.001 RSMo, the department is required to monitor adverse health effects of the environment and prepare population risk assessments regarding environmental hazards. These assessments may relate to water, toxics, and others.

Section for Environmental Public Health
The section provides consultation, technical assistance, and inspection services related to food protection, private water supplies, lodging establishments, risk assessments, and environmental investigations and follow-up of communicable disease outbreaks. Licensed private inspectors are now conducting evaluations of existing private water wells and on-site sewage treatment systems for individual homes when requested by lending institutions, realtors, property owners or potential buyers, as allowed in section 701.051 RSMo.

MDHSS maintains statutory authority over on-site disposal systems under Sections 701.025 through 701.059 RSMo and implemented by 10 CSR 20-3.060, Minimum Construction Standards for On-Site Sewage Disposal Systems; 19 CSR 20-3.070, Fees Charged by Department of Health for Inspection of Existing On-Site Sewage Disposal System Requested by a Lending Institution; and 19 CSR 20.3080, Description of Persons Qualified to Perform Percolation Tests or Soils Morphology Examinations in Determining Soil Properties for On-site Sewage Disposal Systems. Domestic, no-discharge sewage treatment facilities that have a designed maximum daily flow or an actual maximum daily flow of three thousand gallons or less fall under these sections. Single family residence with lots of three acres or more are exempted.

Section 701.038 RSMo limits complaint investigation to instances of communicable disease investigation and complaints by an aggrieved party or adjacent landowner. Section 701.040 requires MDHSS to develop a state standard for location, size of sewage tanks, length of lateral lines based on percolation rates or soil properties, construction, installation and operation of on-site sewage disposal systems. The statute goes on to set requirements for inspections, permits, system modification or major repairs and contractor registration, and directs fees be collected.

Persons installing or repairing an on-site sewage system should first contact the County Health Department. Information must be provided on an application indicating the soil and site conditions, systems design, and setback distances. All factors must be acceptable to minimum construction standards before a permit will be issued. Law provides penalties for installation of systems without required permits.

US Department of Agriculture

Natural Resources Conservation Service and Farm Service Agency
The Natural Resources Conservation Service (NRCS) and the Farm Service Agency (FSA) in the U.S. Department of Agriculture have traditionally provided technical and financial assistance to landowners, producers and others needing to apply conservation practices. NRCS, formerly the Soil Conservation Service, has provided guidance for over sixty years in soil and water conservation. FSA, formerly the Agricultural Stabilization and Conservation Service, determined practices which would be cost-sharable, set cost share rates, and issued checks. The conservation provisions of the 1996 farm bill simplified existing conservation programs and improved their flexibility and efficiency. The bill also created new programs to address high priority environmental protection goals. While the NRCS and the FSA retained the essence of their traditional roles of technical assistance and financial assistance respectively, the 1996 farm bill redefined and blended their responsibilities and authorities in targeting assistance and setting eligible cost shareable practices and rates.

The 1996 farm bill reformed an existing program, the Environmental Conservation Acreage Reserve Program (ECARP) which encompassed the existing Conservation Reserve Program, the new Environmental Quality Incentives Program (EQIP) and the Wetland Reserve Program (WRP). It phased in EQIP while ending the Agricultural Conservation Program, Colorado River Basin Salinity Control Program, Water Quality Incentives Program and the Great Plains Conservation Program.

Conservation Reserve Program: The Conservation Reserve Program (CRP) protects highly erodible and environmentally sensitive lands with grass, trees and other long-term cover. It allows up to 36.4 million acres to be enrolled nationally at any one time. New enrollments can replace expired or terminated contracts. It allows owners or operators who entered into a contract before 1995 to terminate contracts on certain acres after giving written notice. Those contracts must have been in effect for at least five years. Lands with high environmental values are not eligible for early release.

Conservation Reserve Enhancement Program (CREP): The Conservation Reserve Enhancement Program is a new initiative established as part of the highly successful Conservation Reserve Program. CREP expands CRP's effectiveness by allowing USDA to work in partnership with States and local interests to meet specific conservation objectives. CREP is a community-based program, centered around local participation and leadership, with financial incentives and technical assistance provided by USDA. It is results-oriented, requiring clean program goals and

annual monitoring to measure progress and ensure success. Like CRP, CREP contracts require a 10 to 15-year commitment to keeping lands out of agricultural production, ensuring lasting benefits.

Environmental Quality Incentives Program (EQIP): The Environmental Quality Incentives Program is a new program, which combines the functions of the Agricultural Conservation Program Water Quality Incentives Program, Great Plains Conservation Program and the Colorado River Basin Salinity Control Program. It was funded nationally at $130 million in fiscal year 1996, $200 million in 1997 and 1998 and $175 million in 1999. Livestock-related conservation practices will receive 50 percent of program funding on a national basis.

Conservation priority areas are established locally where significant water, soil and related natural resource problems exist, in cooperation with state and federal agencies and with the state technical committees. Higher priority for funding is given to areas where state or local governments offer financial or technical assistance, or where agricultural improvements will help meet water quality objectives. EQIP establishes five-to ten-year contracts to provide technical assistance and pay up to 75 percent of the costs of conservation practices focusing on manure management, pest management and cropland erosion control.

The bill defines land eligible for EQIP contracts as agricultural land that poses a serious problem to soil, water or related resources. It does not allow large livestock operations to be eligible for cost-share assistance for animal waste management facilities, but they do remain eligible for technical assistance. Activities must be carried out under the contract according to a conservation plan. Total cost-share and incentive payments are limited to $10,000 annually per person and to $50,000 for the life of the contract.

Wetland Reserve Program: The Wetland Reserve Program (WRP) incorporates changes designed to provide more flexibility to farmers and sets an enrollment cap of 975,000 acres nationally. The revisions require one-third of total program acres be enrolled in permanent easements, one-third in 30-year easements, and one-third in restoration only cost-share agreements. Individuals may choose the category for their eligible land. Landowners are provided up to 100 percent cost-sharing for permanent easements, 75 percent for 30-year easements and 75 percent for restoration cost-share agreements.

Conservation Research and Education: The National Natural Resources Conservation Foundation has been created as a charitable nonprofit corporation to fund research and educational activities relating to conservation on private lands. The foundation promotes innovative solutions to conservation problems through public-private partnerships. It also accepts private gifts of money or property to be used for conservation activities. Congress authorized $1 million annually from 1997 through 1999. The new foundation offers grants for research, education and demonstration projects. Grants will also assist conservation districts in building resources to carry out local conservation programs.

Conservation of Private Grazing Land: The grazing lands provision ensures technical,

educational and related assistance is provided to landowners on the nation's 642 million acres of private grazing lands.

Flood Risk Reduction: Voluntary contracts are authorized that provide one lump sum payment to producers who farm land with high flood potential. The payment will equal 95 percent of the seven-year marked transition payments and other payments to offset estimated federal outlays on frequently flooded land. In return the producer agrees to comply with applicable wetlands and highly erodible land requirements and to forego commodity loans, crop insurance, conservation program payments and disaster payments.

Wildlife Habitat Incentives Program: This provision helps landowners improve wildlife habitat on private lands. It provides cost-sharing to landowners for developing habitat for upland wildlife, wetland wildlife, endangered species, fisheries and other wildlife. The state technical committee is to be consulted for setting priorities for cost-share measures and habitat development projects.

Emergency Watershed Protection Program Floodplain Easements: The Secretary is authorized to purchase floodplain easements under the Emergency Watershed Protection Program.

Watershed Protection and Flood Prevention Act (PL-566)
PL-566 authorizes the U.S. Secretary of Agriculture to cooperate with state and local agencies in planning and carrying out improvements for soil conservation and other purposes. It provides for technical, financial, and credit assistance, by USDA, to local organizations representing the people living in small watersheds. It also provides for needed additional treatment and protection of federally owned lands within these watersheds.

The Watershed Protection and Flood Prevention Act works through local government sponsors and helps participants solve natural resource and related economic problems on a watershed basis. Projects include watershed protection, flood prevention, agricultural water management, erosion and sediment control, rural water supplies and water quality, fish and wildlife habitat enhancement, wetlands creation and restoration, and public recreation in watersheds of 250,000 or fewer acres.

Both technical and financial assistance are available through NRCS which provides allocations of funds for plan development and implementation of individual projects. A project application must be submitted by local sponsors and prioritized by the Missouri Soil and Water Conservation Districts Commission prior to NRCS planning assistance. Project sponsors can be local or state units of government and usually include soil and water conservation districts and local watershed subdistricts. Practices to improve water quality through watershed land treatment are eligible for financial assistance with PL-566 funds.

Resource Conservation and Development Program: Resource Conservation and Development (RC&D) is a program which helps people initiate, sponsor, plan and implement projects that will benefit their communities. NRCS administers the program and provides a coordinator to designated RC&D areas. Local councils define the goals and objective to meet local needs. Councils may seek technical assistance from federal, state and local governments, local soil and water conservation districts and private industry. They may also seek and accept donations, loans, grants, or cost-sharing arrangements to help fund projects that address land conservation, water management, community development or environmental enhancement.

Forestry Incentives Program: The Forestry Incentives Program was authorized by Congress in 1973 to share with private landowners the cost of tree planting, timber stand improvement and natural regeneration. Provisions were unchanged in the 1996 farm bill. The objective is to increase the nations supply of timber products with emphasis on continued sustained yield; cost-effective forest improvement practices; and enhancement of other forest resources. Federal annual cost share ranges up to 75 percent depending on county participation and cost share rates set for that county. Fencing is required, but not cost shared. A one-acre minimum wooded contract area is required.

Stewardship Incentive Program: The Stewardship Incentive Program is designed to encourage private landowners to actively manage their forest land and improve natural resources by providing cost-share assistance for the installation of environmentally oriented practices - plan development, reforestation and afforestation; forest improvement, agroforestry establishment; soil and water protection; riparian and wetland protection; fisheries habitat enhancement; wildlife habitat enhancement; forest recreation enhancement; and reforestation. A ten-acre minimum of wooded area is required except in agroforestry. The MDC has in recent years provided additional matching funds to keep the program intact.

Forest Service

The Forest Service is charged with promoting the sustainability of ecosystems and providing public service through conservation leadership. Providing benefits from the National Forest is a primary thrust of multiple use and sustained yield management. The signing of the Record of Decision for the final EIS in 1986 represents the first level of decision making related to land and resource management planning. This decision determined the desired future condition of the Mark Twain National forest and established the standard and guidelines under which future projects would be implemented. This document was completed in accordance with the National Environmental Policy Act (NEPA) and the Council of Environmental Quality implementing regulations for NEPA. The Mark Twain Land and Management Resource Plan currently directs Forest management activities, including timber management, recreation, wilderness, fisheries, range, roads, minerals, fire, soils, water and air. Final level decisions focuses on the analysis and implementation of management practices and projects designed to achieve the goals and objectives of the Forest Plan, subject to FOIA and NEPA.

Specific language regarding Forest Service management is contained with the following 36 CFR Sections:

219.23 - forest planning shall provide compliance with requirements of the Clean Water Act and evaluation of existing or potential watershed conditions that will influence soil productivity, water yield, water pollution or hazardous conditions

219.27 – "conserve soil and water resources...", "provide for adequate fish and wildlife habitat to maintain viable populations...", and manage riparian areas to avoid detrimental water temperature and chemical composition changes, blockages of water course or deposits of sediment.

US Environmental Protection Agency

Agriculture Compliance Assistance Center: The US Environmental Protection Agency (EPA) with the support of the USDA has developed a national Agriculture Compliance Assistance Center (Ag Center) to provide a base for "one-stop shopping" for the agriculture community - one place for comprehensive information about approaches to compliance that are both environmentally protective and agriculturally sound. The Ag Center seeks to increase compliance by helping the agricultural community identify common sense ways to comply with environmental requirements.

The Ag Center will work with USDA and other federal and state agencies to provide information on topics such as pesticides; nonpoint source pollution; ground, surface and drinking water protection; animal waste management; agricultural worker protection and wetlands protection. It will also support regional and state regulatory agencies in their efforts to provide compliance assistance to local agriculture.

Office of Wetlands, Oceans and Watersheds
Nonpoint Source Control Programs: The Assessment and Watershed Protection Division serves as the national program manager for EPA's nonpoint source control efforts. It also assists and guides nonpoint source programs that each state is required to develop under Section 319 of the Clean Water Act. Under Section 319 EPA has awarded more than $420 million to States in 1990-1996. States use these grants to implement programs approved by EPA that include as appropriate, nonregulatory and regulatory programs for enforcement, technical assistance, financial assistance, education, training, technology transfer, and demonstration projects.

Total Maximum Daily Load Process: A challenging task faced by water program administrators in addressing water pollution is determining the specific pollution control measures necessary to meet and maintain water quality goals and standards. Section 303(d) of the Clean Water Act describes ways to approach this task through the establishment of Total Maximum Daily Loads (TMDLs). The TMDL is the greatest amount of pollutants that a waterbody can receive without violating water quality standards.

The Assessment and Watershed Protection Division assists states in implementing programs that

target watersheds for TMDL calculations. After a watershed has been identified for priority attention, and the TMDL has been established, individual waste load allocations (or limits) are designated for point and nonpoint sources (taking into account natural background levels, as well as a margin of safety). After implementing any additional pollution control measures that may be necessary to meet the TMDL, monitoring is conducted to assess the effectiveness of these control actions.

Wetlands Protection Measures: EPA's wetland protection regulatory responsibilities include reviewing proposed dredged or fill materials disposal activities under Clean Water Act Section 404 and Section 10 of the Rivers and Harbors Act and, if appropriate, restricting or prohibiting the use of discharge sites for these activities. EPA also develops regulations, policies and guidance to provide environmental criteria for discharges of dredged or fill material into wetlands regulated under Section 404. A technical testing manual is being developed to evaluate proposed discharges of dredged material in waters of the United States, including wetlands.
Watershed Protection: EPA has turned to naturally defined hydrological ecosystems--watersheds-- as the primary focus for effort to protect and restore natural resources. A comprehensive approach is needed that takes into account threats to human and ecosystem health within specific watersheds. To some extent, this approach requires a departure from EPA's traditional focus on regulating specific pollutants and pollutant sources and an alignment of traditional regulatory and nonregulatory programs to support integrated natural resource management. Based on successes of comprehensive, aquatic ecosystem programs such as the Chesapeake Bay, EPA is promoting similar approaches across the nation in watersheds large and small, urban and rural.

Technical Assistance: The Office of Wetlands, Oceans and Watersheds (OWOW) recognizes the need for a strong base of scientific information as the foundation for making regulatory and nonregulatory decisions about resource protection and management and evaluating program success. The Office of Science and Technology (OST) is the primary technical support arm for all water programs and liaison with EPA's Office of Research and Development (ORD). OWOW works with OST and ORD to support research and develop technical guidance for programs. Technical support and information are provided to citizens, local governments, states and other federal agencies regarding water quality monitoring, assessment, and regulation.

Surface Water Quality Monitoring and Data Management: The Assessment and Watershed Protection Division prepares technical guidance for assessing water quality and program successes, develops water quality indicators, and coordinates surface water monitoring programs with related programs in EPA and elsewhere. Water quality data is available and useable nationwide through Storage and Retrieval (STORET) and other systems. A Geographic Information System (GIS) center to support water quality decision-making is being established. The Division also prepares the biennial National Water Quality Inventory, a report to Congress

that aggregates and analyzes state reports of water quality data in a periodic snapshot of water conditions nationwide. Biological monitoring is being emphasized and supported through development and publication of protocols and methods. Guidance and a newsletter are also prepared to help volunteer monitoring programs nationwide.

US Department of Interior

U.S. Geological Survey, Water Resources Division

The mission of the U.S. Geological Survey (USGS) Water Resources Division (WRD) is to provide reliable, impartial, timely information that is needed to understand the Nation's water resources. WRD actively promotes the use of this information by decision-makers to:

1. Minimize the loss of life and property as a result of water-related natural hazards, such as floods, droughts and land movement.
2. Effectively manage ground water and surface water resources for domestic, agricultural, commercial, industrial, recreational and ecological uses.
3. Contribute to wise physical and economic development of the Nation's resources for the benefit of present and future generations.

The USGS WRD has neither regulatory nor developmental authority; therefore, its sole product is information.

Consistent with the USGS mission, the WRD provides impartial, credible, and excellent science that is applied to issues relevant to water resources management, protection from hydrologic hazards, environmental protection and other public policies. WRD's primary strengths include:

1. Collecting, quality assuring, storing and disseminating basic hydrologic data on the quantity and quality of water.
2. Conducting assessments of availability of water, quality of water, water use, and water related hazards at scales that range from single data collection sites to regional and national scale.
3. Conducting interpretative studies and developing predictive models that describe the potential consequences of water related management actions.
4. Providing knowledge and expertise to assist various levels of government (Federal, State, local) in understanding and solving critical water resources problems.
5. Developing new methods for acquiring water resources information, including methods of data collection, quality assurance, data management, laboratory analysis, data analysis and simulation modeling.
6. Producing new understanding that describes or explains processes important to water related issues.

Federal Water Quality Programs

The USGS WRD actively proposes and annually funds water quality programs of a National scope. These programs are funded solely from the annual USGS congressional appropriation. Two programs, which are significant contributors to the National water quality database, are the National Water Quality Assessment and the National Stream Quality Accounting Network programs.

National Water Quality Assessment Program (NAWQA):

The NAWQA program was conceived in 1986 through Congressional appropriated funds that mandated the USGS to test and refine concepts for a long-term program to:

1. Provide a nationally consistent description of current water quality conditions for a large part of the Nation's water resources,
2. Define long-term trends in water quality, and
3. Identify, describe and explain, as possible, the major factors that affect observed water quality conditions and trends.

After a 4-year pilot phase of the NAWQA program, a committee of the National Academy of Science evaluated the design and potential utility of the program and recommended full-scale implementation for 20 study units in 1991.

The Ozark Plateaus region was one of the initial study units to be assimilated into the NAWQA program. The study unit is approximately 48,000 square miles in size and includes parts of northern Arkansas, southeastern Kansas, southern Missouri, and northeastern Oklahoma. Boundaries of the study unit approximate the natural flow boundaries of the Ozark Plateaus aquifer system. The study objective is to examine the major factors that affect the quality of surface waters and to assess trends of water quality in Ozark streams. Interpretation and presentation of data is published in a series of reports. The area is of particular NPS interest because of the growing number of confined animal feeding operations within Missouri.

National Stream Quality Accounting Network (NASQAN):

The NASQAN program began in 1973 to provide nationally comparable information on water quality. Consistent with the design of the national streamflow-gauging network, water quality measurements were made at stations at the downstream end of most *hydrologic accounting units*; hence, the term *accounting* in the network name. At its greatest extent, the network was funded at $5 million annually and included more than 500 stations that were sampled monthly for suspended sediment, major ions (such as sulfate and chloride), trace elements (such as lead), nutrients (such as nitrate and phosphorus), sanitary indicators (such as fecal coliform), and limited biological information (such as chlorophyll-a). These data were intended to provide general-purpose information on the status and trends of water quality.
During 1993 and 1994, the NASQAN program underwent a major restructuring. This involved

reducing the total number of stations and increasing the number of samples to be collected at each station. In addition, the parameter list was revised to include more of the chemicals, compounds and constituent elements that are relevant to current water quality management issues. Since 1995, the NASQAN program has focused on monitoring the water quality of four of the Nation's largest rivers--the Mississippi, the Columbia, the Colorado and the Rio Grande. NASQAN operates a network of 39 stations where the concentration of a broad range of chemicals, including pesticides and trace elements, and stream discharge are measured. From these data, source areas of contaminants can be identified; contaminants can be routed through the river system to determine gains and losses; and the amount of contaminants delivered to receiving waters--such as estuaries and reservoirs--can be estimated.

Three NASQAN stations are currently maintained in Missouri under the restructured program. These stations are the Missouri River at Hermann, the Mississippi River below Grafton, and the Mississippi River at Thebes. Samples are collected at these stations between 13 and 15 times a year. At least two samples are collected to represent events of extremely high flow including flood stage. About 100 dissolved constituents and 30 suspended constituents are measured in every sample. An extensive quality assurance/quality control program enables constituents present in very low concentrations (parts per billion) to be measured with definable accuracy and precision. Results are published annually by the Missouri District WRD office.

Water Resources Division Funding Sources

WRD achieves its mission by using funding from three distinctly different sources: (1) USGS Federal program funds, which provide 100 percent support for certain efforts; (2) Federal-State Cooperative program funds, which are a combination of Federally appropriated funds (up to 50 percent) and funds from cooperating agencies at the State and local level; and (3) reimbursable funds, which are contributed by various partners without any Federal match. Each source of funding brings its own benefits. The Federal program provides the foundation that allows WRD to address important national issues, and provides for the conduct of regional and national synthesis of data and information, which is unlikely to be funded by local, State and other Federal agencies. Federal programs also provide the primary source of funds for research and development, which is necessary for the long-term productivity of WRD and the hydrologic science community.

The Federal-State Cooperative program and the reimbursable program ensures the relevance of WRD work and helps WRD to identify emerging issues. The programs provide a base of support for long-term data collection networks and interpretative projects that can be integrated to give regional and national understanding of the Nation's water resources. These programs and the Federal program also provide a network of field sites in diverse geographic and hydrologic environments where the USGS and others can test new scientific approaches, methods, and instruments under real world conditions.

Technical Assistance and Support Offered by the Missouri District

WRD activities in Missouri are conducted from three offices statewide by a staff of hydrologists, geologists, engineers, hydrologic technicians and support personnel. Consistent with the USGS WRD mission, the Missouri District is available to provide assistance in the collection and interpretation of water quality, ground water and surface water data. Below is a list of potential areas where the Missouri District can assist the NPS through either its Federal-State Cooperative or reimbursable funds program:

1. Data collection and interpretation to determine contaminants loads in runoff from agricultural areas to "waters of the state."
2. Calibrate hydrologic and water quality models for use in simulating water quality conditions of watersheds where minimal data are available.
3. Establish new baseline water quality monitoring networks or enhance existing networks to meet the demands of current water quality issues.
4. Refine the current understanding of the regional aquifers to better understand their susceptibility to the growing number of confined animal feeding operations (CAFO).
5. Provide storm water quality data collection and interpretation in urban areas.
6. Collect ground and surface water data to support the calibration of models to determine source area concerns for public and private drinking water resources.
7. Conduct research into the sources and types of microorganisms entering the hydrologic system as a result of the growing number of CAFOs.
8. Conduct biological monitoring as a tool in assessing stream health.
9. Using engineering models, show the affect of impoundment and other flow routing scenarios on the fate and transport of chemical and biological contaminants.
10. Conduct hydrologic and water quality assessments of implemented best management practices.
11. Refine the understanding of contaminant transport, on a large (watershed) scale, through the unsaturated zone within the various regions of the state.
12. Store all USGS collected water quality data in the National Water Information System data base.
13. Conduct geochemical investigations into environmental contamination resulting from mining and mine tailing storage.
14. Assess impacts of NPS contaminants on wetlands in Missouri.
15. Compute chemical mass balances in watersheds for determining contaminant assimilation capacities of receiving streams and lakes.

Fish and Wildlife Service

Partners for Fish and Wildlife: The US Fish and Wildlife Service (Service) began a national program in 1989 called Partners for Wildlife Program which was aimed at the restoration and enhancement of wetlands and associated uplands on private lands. Recently the program has expanded and the name changed to Partners for Fish and Wildlife. The program now includes the restoration and enhancement of riparian and in-stream habitats for fish, wildlife and federally-listed threatened and endangered species. In Missouri the program is being

implemented cooperatively with the Missouri Department of Conservation (MDC). Its purpose is to restore and enhance wetlands, grasslands, streams and rare and declining habitats on private land through the establishment of fish and wildlife habitat development agreements or partnerships with private organizations, corporations and individual landowners.

The Service and MDC provide technical assistance to the landowner(s) with cost share being provided through the Service in exchange for a habitat development agreement stipulating that the restored or enhanced land will not be altered or modified during the term of the agreement. The cost share rate is 75 percent for ten years of program participation. Twenty-year or longer development agreements are possible at the landowner's discretion.

Challenge Cost Sharing: A companion program to the Partners for Fish and Wildlife Program, is the Challenge Cost Share Program which allows the Service to provide matching funds for projects that support the management, restoration and protection of natural resources on wildlife refuges, fish hatcheries, research facilities and private lands. The goal is to restore and enhance natural resources on federal and private lands in partnership with nonfederal public and private institutions, organizations and individuals. The Service provides up to 50 percent of the total project cost and cooperators provide the other 50 percent. Partners may contribute cash or in-kind services. A Challenge Cost Share Agreement defines the purpose and scope of the project, assigns partner responsibilities and certifies the contribution.

University of Missouri

The University of Missouri and University Extension provide the general public with research-based objective information. University Extension uses demonstrations and educational programming to show the practical application of this research to Missouri citizens.

Missouri is divided into eight Extension regions and serviced by regional specialists. University Extension's strong feature is the development and dissemination of educational programs and demonstrations. By combining the educational training and talents of regional Extension specialists, community programs cover a wider spectrum of problem solving techniques and skills. University Extension strives to develop working relationships in communities with citizens and other agencies. Educational programs, demonstrations and in-service education seminars are available for agencies and the general public.

Water quality is a major focus area of University Extension on the state and regional level. Emphasis on educational programming, information and demonstration is used to promote water quality and continued learning throughout the state.

Missouri Watershed Information Network

The Missouri Watershed Information Network (MoWIN) is being established within the University Outreach and Extension Division to assist individuals, governmental and private

agencies, schools and other groups in locating and accessing information about Missouri watersheds. MoWIN is a partnership of state and federal agencies, non-governmental organizations, natural resource interest groups, and private industry working together to facilitate access to watershed information in Missouri.

The goal of MoWIN is to help citizens increase their knowledge about current watershed conditions and best watershed management practices and strategies to improve Missouri's water quality.

MoWIN will provide information about: current watershed events and meetings, ongoing projects, local contacts, human resources, financial assistance, technical assistance, educational resources, and natural resource facts, reports and data. The information will be provided via the Internet, phone, fax, mail and personal visits.

Agriculture Private Sector

Agricultural organizations are a vital liaison between the government agencies and producers as leaders can help inform producers about new programs and regulations while giving input to agencies about such programs. The agricultural community has been extremely proactive in decreasing nonpoint source pollution by implementing a number of environmental programs, and by fostering a sense of cooperation between agencies and agribusiness.

Missouri Corn Growers Association
The Missouri Corn Growers Association is promoting NPS pollution prevention and cooperates in water quality initiatives that cut across agency and organization lines. It is embarking on BMP demonstration and watershed research projects to be implemented in various watersheds around the state. The projects will deal with pesticide runoff with the constituent of focus being atrazine. Potential management practices which will help reduce atrazine will be evaluated. Objectives are:

A. Measure the effectiveness of selected management practices in reducing the runoff of pesticides, nutrients and sediment from crop fields, with specific emphasis on atrazine, nitrogen and phosphorus reduction.
B. Monitor streams, tributaries and reservoirs in sub-watersheds to document trends and/or changes in pesticides, nutrient and sediment levels within these specific watersheds resulting from the implementation of selected nutrient and pesticide management practices.

Producers participating in whole field demonstrations targeting the effectiveness of selected management practices in reducing runoff will receive technical assistance, including nutrient, pest and forestry management and engineering support. Information will be collected on a field-by-field basis including all pesticide and nutrient applications, and the date, rate and type of product applied. Information will be gathered on tillage practices, timing, type of implement

used, seeding dates, rates, varieties, all field inputs. This information will then be used to evaluate the economics of the cropping system through the use of the "MAX" program. (MAX, Farming for MAXimum Efficiency, is an economic management decision software developed by the Conservation Technology Information Center at Purdue University in Indiana.) All field locations and sampling stations will be tracked using a GPS mapping system.

Mo-Ag Industries Council

Mo-Ag Clean Pesticide Container Recycling Program

The Mo-Ag Clean Pesticide Container Recycling Program was established in 1991 to provide Missouri's agrichemical dealers and growers with an alternative to landfilling clean pesticide containers. Goals for this program are three-fold:

1. To provide an environmentally sound method of disposing of used, clean containers
2. To prevent NPS caused by stormwater washing pesticide residues into waters of the state, and
3. To inform dealers and growers on proper methods of cleaning pesticide containers as required by law.

Because of the growing concern over illegally burning pesticide containers and other environmental concerns, the Agricultural Container Research Council (ACRC) was formed in 1992 to promote the collection and recycling of empty crop protection chemical containers into innovative, environmentally sound end uses. The organization supports state-level container programs by designating contractors to granulate and transport flaked containers to recycling centers from state approved collection sites. The assigned sub-contractor for the state of Missouri is Tri-Rinse, St. Louis Missouri. ACRC provides this vital service for state-level programs; however, Mo-Ag Industries Council meets the balance of the administrative and other expenses. Volunteers perform the work. Mo-Ag provides educational and promotional materials and protective gear including gloves, aprons, earplugs and boots.

The Mo-Ag Clean Pesticide Container Program begins in late winter and usually ends with collection of containers in August and October. The program targets the collection of high density polyethylene (HDPE) containers two and one half gallons or less, but will take up to 55 gallon ag chemical containers. Mini bulk containers can be recycled by contacting the sub-contractor. In 1997, Mo-Ag collected over 140,000 pounds of ag chemical containers. The chipped containers are now being used to make plastic industrial pallets that are used at ag-chem facilities or distributions, which can be used again and again. Other end uses of the collected plastic have included new pesticide containers and energy recovery.

Environmental Studies Internship

In 1998, Mo-Ag plans to offer an internship program for students through the Environmental Studies program at the University of Missouri. By participating in the collection and granulation process, a student will be able to earn one or two credits toward his/her degree.

Missouri Soybean Association

Representative Farm Economical and Environmental Model
The MSA, (Missouri Soybean Association) and FAPRI (Food and Agriculture Policy Research Institute) initiated this program to provide farmers information on ways to improve profitability and the environment by keeping soil, nutrients and crop chemicals in the field where they belong. This computer model is being developed by FAPRI will include three major soil regions of Missouri. Four to five farmers and an ag chemical dealer develop representative farms for their soil region. The individual farmers combine their financial and management practices to develop a "model" farm.

This project will provide producers from each region economical and environmental information about current management (baseline) and alternatives (future options). With this information a producer will be able to identify what environmental and/or financial impacts can be expected from a practice, e.g., planting a cover crop. The model may suggest altering chemical and fertilizer timing or a major change in crop management, all with the goal of improving farmers' profitability while protecting the environment. People who are planning or in the process of making changes to meet the requirements will receive a three-year membership to the MSA after they complete their projects.

MSA Environmental Excellence Award. This program is designed to recognize a person in the state of Missouri who has made outstanding strides in adopting environmentally friendly, economically sustainable, practices. This person also receives a cash award for achievement in preventing movement of soil, nutrients and crop chemicals.

MFA Inc.
Pesticide Container Recycling
MFA serves as a collection point for properly rinsed pesticide containers that are then transported to sites for recycling.

Custom Applicator Rodeos
MFA sponsors applicator rodeos which not only are competitions for skills but which also test the participants for compliance with rules and regulation associated with pesticide application.

Grass Buffer Strip Program
As a member of the National Council of Farmer Cooperatives, MFA is sponsoring a nationwide program which encourages agricultural producers to sow grass buffer strips along waterways to filter and reduce sediment and crop protection chemical runoff from agricultural fields.

Missouri Poultry Federation
The Missouri Poultry Federation makes available a compilation of BMPs with guidelines for litter management and dead-bird composting produced by the US Poultry and Egg Association, NRCS, the Tennessee Valley Authority and EPA. The Federation, working with the Poultry Task Force (public, private and industry representatives) is supporting efforts to achieve 100 percent participation of poultry contract growers in obtaining a voluntary "Letter of Approval" from DNR. A cooperative Poultry Federation/NRCS program in Barry County provides

technical assistance to growers in soil and litter nutrient testing for planning application rates.

Poultry companies plan to become more involved in growers' handling of litter. Flock servicemen visit sites weekly and will encourage BMP utilization and refer growers to appropriate sources for assistance. Independent contractors who haul litter will be addressed in hauler seminars.

Missouri Pork Producers Association

Environmental Assurance Program

The Environmental Assurance Program (EAP) began in Missouri in 1996 as an educational opportunity for pork producers. The original program included a basic understanding of environmental stewardship, a review of regulations, and an environmental audit to help producers plan for the future.

To continue addressing environmental issues, the National Pork Producers Council has developed five new modules that elaborate on specific areas of the original program. The modules are Composting, Odor Reduction, Manure Treatment and Storage Alternatives, Community Relations, and Pollution Prevention Strategies. The original EAP and the five new modules are currently available to producers through local workshops that are conducted by University Extension and Natural Resources Conservation Service personnel.

On-Farm Odor Assessment Program

The On-Farm Odor Assessment Program was developed to give individual pork producers advice on ways odor may be reduced and how they may improve environmental stewardship on their operations. The program will be conducted through site visits made by agricultural engineers and other resource people from University Extension, the Natural Resources Conservation Services, and private firms.

Following the on-farm visit, the participant will receive a written report regarding their operation. All information gleaned from the visit will remain confidential; it will be the decision of the producer to implement the suggested changes. The program will be available to producers in March 1998.

Syngenta

Missouri Water Quality Program

Since 1995, Syngenta has offered a voluntary water monitoring program for triazine herbicide to any public water supply that wished to be involved. As of 1998, thirty-three public water supplies in Missouri participate in the program. Syngenta provides an immunoassay kit, mailing expenses and laboratory analysis. Both finished and raw water samples are taken by the public water supply twice a month except during late spring and summer where samples are taken weekly. Syngenta utilizes gas chromatography for split sampling of at least 10 percent of all samples.

Syngenta also partners with the Missouri Corn Growers Association and other federal and state

agencies in the Watershed Research and Assessment Project. This five-year project will focus on agricultural field runoff reduction practices, education, outreach and the economics of such practices. Syngenta has also sponsored many federal, state, local and nonprofit water stewardship programs and meetings. In 1997, Novartis sponsored an Environmental Stewardship Award given through the Missouri Soybean Association.

IMPLEMENTATION ASSISTANCE CONTACTS

MISSOURI DEPARTMENT OF NATURAL RESOURCES

Water Protection & Soil Conservation
205 Jefferson Street
P.O. Box 176
Jefferson City, MO 65102

Soil and Water Conservation Program	(573) 751-4932
Water Pollution Control Program	(573) 751-1300
Public Drinking Water Program	(573) 751-5331
Land Reclamation Program ALPD	(573) 751-4041
Environmental Assistance Office	(573) 526-6627
	(800) 361-4827

Geological Survey and Resource Assessment Divison

Water Resources Program	(573) 751-2867

205 Jefferson Street
P.O. Box 176
Jefferson City, MO 65102

Geological Land Survey Program	(573) 368-2100

111 Fairgrounds Road
P. O. Box 250
Rolla, MO 65401

MISSOURI DEPARTMENT OF AGRICULTURE

1616 Missouri Boulevard	(573) 751-4211

P.O. Box 630
Jefferson City, MO 65102

MISSOURI DEPARTMENT OF CONSERVATION

2901 W. Truman Blvd.	(573) 751-4115

P.O. Box 180
Jefferson City, MO 65102

MISSOURI DEPARTMENT OF HEALTH AND SENIOR SERVICES

Information and assistance are available from health departments or nursing services located in most counties.

931 Wildwood	(573) 751-6400

P.O. Box 570
Jefferson City, MO 65102

US DEPARTMENT OF AGRICULTURE

Information and technical assistance are available from USDA service centers located in most counties.

Natural Resources Conservation Service
or Forest Service (573) 876-0900
Parkade Center, Suite 250
601 Business Loop 70 West
Columbia, MO 65203

Farm Services Agency (573) 876-0932
Parkade Center, Suite 225
601 Business Loop 70 West
Columbia, MO 65203

US ENVIRONMENTAL PROTECTION AGENCY

USEPA Region 7 (913) 551-7000
901 N 5th Street
Kansas City, KS 66101

US DEPARTMENT OF INTERIOR

Geological Survey (573) 308-3500
1400 Independence Road
MS 200
Rolla, MO 65401

Fish and Wildlife Service (573) 875-1911
608 East Cherry, Room 200
Columbia, MO 65201

UNIVERSITY OF MISSOURI EXTENSION

Contact the office in your county for information or assistance.

AGRICULTURE -- PRIVATE SECTOR

Missouri Corn Growers Association (573) 893-4181
3118 Emerald Lane, Suite 110
Jefferson City, MO 65109-6860

Missouri Ag-Industries Council, Inc. (573) 636-6130
410 Madison
P.O. Box 1728
Jefferson City, MO 65102

Missouri Soybean Association P.O. Box 104778 Jefferson City, MO 65110-4778	(573) 635-3819
MFA Inc. 201 Ray Young Drive Columbia, MO 65201	(573) 876-5226
Missouri Poultry Federation 225 East Capitol Avenue Jefferson City, MO 65102	(573) 761-5610
Missouri Pork Producers Association 6235 Cunningham Drive, Route 11 Columbia, MO 65202-9612	(573) 445-8375

APPENDIX K

Proposed Water Quality Monitoring Program for Missouri

A PROPOSED
WATER QUALITY MONITORING PROGRAM
FOR MISSOURI

May, 1999

A comprehensive water monitoring plan includes components for monitoring both quality and quantity of surface and ground waters. A complete program includes:

1. FIXED STATION NETWORK where measurements are made, usually at fixed intervals at the same site over a period of many years. This network includes both chemical and biological monitoring sites.

2. SPECIAL STUDIES where a specific issue or question results in a relatively intense monitoring effort over a short period of time, usually to define cause and effect relationships. DNR uses these studies to support such actions as issuance of site specific, water quality based NPDES permits, documentation in support of enforcement actions for serious water pollution events and for development of water quality criteria.

3. SCREENING LEVEL DATA COLLECTION where large numbers of sites can be quickly evaluated for obvious water quality problems and can assist in directing more intensive monitoring.

Fixed Station Water Quality Network: Surface Water Chemistry

The present fixed station chemical water quality monitoring network in or near Missouri includes 108 sites of which 35 are cooperative sites jointly funded by DNR/WPCP and the USGS, two are cooperative sites jointly funded by DNR/DSP and USGS, six are funded by DNR/WPCP under contract with Crowder College and 65 are maintained by federal agencies, other states, cities and public water suppliers. In addition to this network, the University of Missouri, under contract to the Department of Natural Resources, has been monitoring water chemistry of approximately 110 lakes three times per year since 1988.

While a fixed station network of this size has served the water pollution control needs in the past, the relatively recent influx of large confined animal feeding operations (CAFOs), expansion of mining activities, continued controversy over gravel mining, and the need for more water quality information in and around critical watersheds in the state makes some additions to the present network advisable. DNR has recommended initiation of an additional 27 new monitoring sites and upgrading of six of the present sites. Included in this recommendation are three new stations in north Missouri to assess the impacts of existing large or other significant water contaminant sources, and upgrading of six existing sites in southwest Missouri to better assess the impacts of the significant poultry production in that area of the state. Several of the remaining new sites

proposed would allow the department to develop information on existing water quality in areas which may some day be impacted by anthropogenic activities.

Existing and proposed expansions to the surface water chemistry network are shown in Element One below. Biological monitoring would be added to those sites appropriate for that type of monitoring.

Fixed Station Water Quality Network: Bioaccumulation of Toxics

From 1980 through 1993 DNR and EPA operated a cooperative Regional Ambient Fish Tissue Monitoring Program (RAFTMP) which analyzed whole fish (carp or redhorse sucker only) from about 20-24 fixed sites in Missouri annually. EPA changed the focus of the program in 1994 from one monitoring ecosystem health to one which more directly assessed human health impacts. The RAFTMP now has only 8 long-term sites monitored annually for whole fish to assess ecosystem health. Six additional fish fillet samples to assess human health risk are taken annually. Individual sampling sites are monitored for one to three years.

Beginning in about 1983 when EPA reported fish in the Meramec River with elevated levels of chlordane and dioxin, the Department of Conservation began their own fish tissue monitoring network. This network did not use fixed sites, but changed most sites annually. It analyzed fish fillets from a variety of species. Thus most fish tissue data collected today is good for assessing human health risks but not so good for other fish eaters which may eat the entire fish (since fillets typically contain less contaminants by weight than the entire fish, analyzing the whole fish is a more sensitive indicator of bioaccumulatable toxicants).

New techniques for estimating bioaccumulatable substances using semi-permeable membrane devices (SPMDs) rather than fish tissue have been developed and are now in commercial use for organic compounds and are in development for heavy metals. If DNR finds this technology to be an acceptable and economically viable substitute for fish tissue sampling, it may replace fish tissue monitoring in part or in total. Specific monitoring locations are listed in Element Two below.

Fixed Station Water quality Network: Sediment Chemistry

One of EPA's major areas of emphasis in the last five years has been the development of sediment criteria. While this criteria development process has proceeded slowly, we anticipate that in the not too distant future, EPA will be urging states to adopt sediment criteria and begin monitoring sediments. DNR initiated a sediment sampling program in 1998. It includes both a fixed station component to document sediment quality on the major rivers and sediment monitoring in sites suspected of having sediment quality problems. Monitoring sites are listed in Element Three below.

Fixed Station Water Quality Network: Bacteria

Presently, bacteria data is collected monthly or 6 times annually at most fixed station chemical monitoring sites (see Element One). In addition, the Department of Natural Resources, DPHP conducts bacterial monitoring at approximately 20 swimming areas within Missouri State Parks and the Little Rock District, Corps of Engineers does some bacterial monitoring at swimming areas on reservoirs in their district, about 8-10 of these sites being in Missouri. Given the proper resources, DNR would like to upgrade the bacterial monitoring program in the following ways:

a. conduct a survey of federal, state and local governments on the locations the most heavily used by swimmers.

b. add bacterial monitoring to any heavily used areas not now monitored.

c. all new sites plus existing sites should be monitored at least every two weeks during the recreational season as defined in the WQ standards.

d. switch from the fecal coliform test to the E.coli test as the indicator of human health risk.

Element 1. Fixed Station Chemical Monitoring of Surface Waters

Note: If information is present in the "Agency" column, the site is presently being monitored by that entity. An "*" next to the "Location" column is a site not now monitored but proposed to be included in an expansion of the network. An "**" next to the "Location" column indicates a proposed upgrade of an existing station (increase in frequency and or parameter coverage).

Waterbody		Location	Agency	Coverage	Freq.	Comments
Mississippi R.		Keokuk	IEPA-GA	c,m	6	
		Alton		c,m		
		Grafton	DNR-GS	c,m		B,T
		Ilsah, ILL.	IEPA-GA	c,m	6	
		Canton		c,m		
	*	Hannibal		c,m		B,T
		E. St. Louis				
		Cape G-Thebes	NASQAN-GS	c,m	12	
	*	Caruthersville				
		Memphis	USGS	c,m		
Missouri R.		St. Joseph	DNR-GS	c,m	12	B,T

Waterbody		Location	Agency	Coverage	Freq.	Comments
		ab. Kansas City	Water Co.	c,m,o	12+	
		Kansas City	KDHE	c,m	12	
		Sibley		c,m		
		Jefferson City		c,m		
		Hermann	NASQAN-GS	c,m		B,T
		ab. St. Louis	Water Co.	c,m,o	12+	
		St. Louis	NBS/LTMP	C	24	
		St. Louis		c,m	12	
Des Moines R.		Keosauqua, Ia.	IDEQ	c,m	12	
		St. Fancisville		c,m	6	
Fox R.	*	Wayland		c,m	12	
Wyaconda R.						
N. Fabius R.						
M Fabius R.						
S. Fabius R.		Taylor	DNR-GS	c,m	12	B,T
North R.						
South R.						
Salt R.		New London		c,m	12	
Salt R.		Center	STLCOE	c,m	4	
N.Fk.Salt R.	*	nr. Hunnewell				B
M.Fk.Salt R.						
Elk Fk.Salt R.						
S.Fk.Salt R.		nr. Santa Fe				
Mark Twain Res.		Several	STLCOE	c,m	4	
Cuivre R.		Troy	DNR-GS	c,m	6	B,T
		nr. Mouth	NBS/LTMP	C,	24	
Dardenne Cr.		nr.mouth	NBS/LTMP	C,	24	
Peruque Cr.		nr.mouth	NBS/LTMP	C,	24	
Tarkio R.		Fairfax		c,m	4	
Nishnabotna R.						
Nodaway R.		Oregon		c,m	12	
		Graham	DNR-GS	c,m	12	B,T
		Burlington Jct		c,m	3	

Waterbody		Location	Agency	Coverage	Freq.	Comments
Big Lake Marsh		Big Lake St. Pk.				
Platte R.		Platte City		c,m	12	
		Sheridan		c,m	3	
		Sharps Station		c,m	4	
102 R.		Hopkins		c,m	3	
Thompson R.		Chillicothe		c,m	12	
		Cainsville		c,m	3	
Weldon R.		Princeton		c,m	3	
Medicine Cr.		Lucerne		c,m	3	
Mussel Fk.	*	Mystic (below PSF)		c,m		N
L.Medicine Cr.	*	Galt (below PSF)				N
Locust Cr.		Unionville		c,m	3	
Grand R.		Sumner	DNR-GS	c,m	12	B,T
M.Fk.Grand R.		Grant City		c,m	3	
M.Fk.Grand R.	*	Albany (below CG)				N
E.Fk.Grand R		Allendale		c,m	3	
Chariton R.		Prairie Hill	DNR-GS	c,m	12	B,T
		Livonia		c,m	3	
E.Fk.Chariton R.		Macon		c,m		
	*	Huntsville		c,m	12	T,N
M.Fk.Chariton R.		Salisbury		c,m	12	
Lamine R.		Blackwater		c,m	6	
	*	Pilot Grove		c,m	3	B
Blackwater R.	*	Nelson		c,m	3	B
Moreau R.		Jefferson City		c,m	3	
Osage R.		ab.Schell City	DNR-GS	c,m	6	B,T
		St.Thomas	DNR-GS	c,m	6	B,T
		nr.Warsaw		c,m	4	
		bl.Bagnell Dam		c,m	3	
Baker Br.		Taberville Prairie				
B.Buffalo Cr.		B.Buffalo Cr.WA.	DNR-GS	c,m	6	A,B
Coakley Hollow		Lk.Ozarks St.Pk.	DPHP-GS	c,m	6	A,B
Hahatonka Spring			DPHP-GS	c,m	6	A,B

Waterbody		Location	Agency	Coverage	Freq.	Comments
Truman Res.		Several		c,m	4	
S.Grand R.		Urich		c,m	4	
Marais des Cygnes		Trading Post, Ks.	KDHE	c,m	12	B,T
		Worland		c,m	12	
L. Osage R.		Fulton, Ks.	KDHE	c,m	12	
Marmaton R.		Ft.Scott, Ks.	KDHE	c,m	12	
1st Nicholson Cr.nr.		Prairie SP	DNR-GS	c,m	6	A,B
Sac R.		Dadeville		c,m	12	
Stockton Res		Several	Spfd-CU	c,m		
McDaniel Lake			Spfd-CU	c,m		
Fellows Lake			Spfd-CU	c,m		
Valley Water Mills Spg.			Spfd-CU	c,m		
Sac R.		Stockton		c,m	3	
Pomme de Terre R.		Polk	DNR-GS	c,m	6	B
PdT Res.		Several		c,m	3	
Pomme de Terre R.		Hermitage		c,m	3	
Bennett Spring			USGS	c,m	12	
Niangua R.		bl.Bennett Spg.	DNR-GS	c,m	6	A,B,T
		Windyville	NAWQA-GS	c,m	4	
Dousinbury Cr.		nr.Wall St.	NAWQA-GS	c,m	12	
Maries R.	*	Westphalia		c,m	3	B
Gasconade R.		Jerome	DNR-GS	c,m	6	B,T
	*	Hooker		c,m	12	B,T
		Rich Fountain		c,m	3	
Osage Fk.Gas.R.	*	nr.Drynob				A,B
Lick Fk.Gas.R.	*	nr.Falcon				A,B
Roubidoux Cr.		Waynesville		c,m	3	
Roubidoux Spring		Waynesville	DNR-GS	c,m	6	A,B
Big Piney R.		Devil's Elbow	DNR-GS	c,m	6	B,T
Paddy Cr.		Slabtown Spg.	NAWQA-GS	c,m	12	
Shanghai Spring		Devil's Elbow	DNR-GS	c,m	6	B,P,N
Meramec R.		Eureka		c,m	6	
		Sullivan	DNR-GS	c,m	12	A,B,T

Waterbody		Location	Agency	Coverage	Freq.	Comments
Courtois Cr.		bl.Hwy.8	DNR-GS	c,m	6	A,B
Huzzah Cr.		bl.Hwy.8	DNR-GS	c,m	6	A,B
Meramec Spring		St. James	DNR-GS	c,m	6	S,B
Bourbeuse R.		Union	DNR-GS	c,m	12	S,B
Big R.		Richwoods	DNR-GS	c,m	6	B,N
Coonville Cr.		St.Fran.St.Park	DNR-GS	c,m	6	A,B
Pickle Cr.		Hawn St.Park	DNR-GS	c,m	6	A,B
Hdwtr Diversion	*	Allenville		c,m	12	B,T
Whitewater R.						
Castor R.						
St. Francis R.		Several		C	6	
		Fisk	USGS	C		
		Silva	STLCOE	C	7	
		Saco		c,m	12	
		Patterson	STLCOE	c,m		
		below Wappapello	STLCOE	c,m		
Lake Wappapello		Several	STLCOE	c,m		
Big Cr.		Sam Baker St.Pk.	DNR-GS	c,m	6	A,B
Little R. ditches		Kennett		c,m	12	
		Horrnersville		c,m		
		Rives	DNR-GS	c,m	12	B,T
St.Johns Ditch						
upper James R.		Several	Spfd.CU	c,m	6	
James R.		ab.Wilson Cr.	City of Spd.	c,m	12+	
	*	Galena				B,R
Finley R.		Riverdale		c,m	12	
		nr.mouth	City of Spfd	c,m	12+	
Kings R.		Berryville,Ark.	ADPCE	c,m	12	B,R
Osage Cr.		ab.Berryville,Ark.	ADPCE	c,m	12	
		bl.Berryville,Ark.	ADPCE	c,m	12	
		Alabam	ADPCE	c,m	12	
Longs Cr.		Denver,Ark.	ADPCE	c,m	12	
White R.	*	bl.Beaver Res.		c,m		B,R

Waterbody		Location	Agency	Coverage	Freq.	Comments
Table Rock Res.		nr.dam	USGS-A	c,m		
Roaring R. Spring			DNR-GS	c,m	6	A,B
Lake Taneycomo	*	Branson	USGS-A	c,m	6	B,T
N.Fk.White R.	*	Tecumseh		c,m	12	A,B,T
Bryant Cr.		Rippee W.A.	DNR-GS	c,m		A,B
Double Spring		Dora	DNR-GS	c,m	6	A,B
Norfork Res.		Tecumseh,Udall	USGS	C	6	
Black R.		Annapolis		c,m	12	
	*	Poplar Bluff		c,m	12	B,T
		Corning,Ark.	ADPCE	c,m	12	
E.Fk.Black R.	*	Johnson Shut-ins				A,B
Current R.		Doniphan	DNR-GS	c,m	12	A,B,T
		Van Buren	GS/NPS	c,m	12	
		Pocohantas,Ark	ADPCE	c,m	12	
L.Black R.		Several		c,m	6	
Fourche R.		Middlebrook,Ark.		c,m		
Spring R.		Thayer	ADPCE	c,m	6	
		Hardy,Ark.	ADPCE	c,m	12	
Mammoth Spring		Mammoth Spg.,Ark	ADPCE	c,m	6	A,B
Eleven Pt. R.		Bardley	DNR-GS	c,m	6	A,B
		Pocohantas,Ark	ADPCE	c,m	12	
Greer Spring			USFS-GS	c,m		A,B
Montauk Spring			NPS-GS	c,m	2	
Welch Spring			NPS-GS	c,m	2	
Pulltite Spring			NPS-GS	c,m	2	
Round Spring			NPS-GS	c,m	2	
Alley Spring			NPS-GS	c,m	2	
Blue Spring			NPS-GS	c,m	2	
Big Spring			DNR-NPS-GS	c,m	6	A,B
Current R.		Montauk, Powder M.	NPS-GS	c,m	2	
Jack's Fk.		nr.mouth	DNR-NPS-GS	c,m	12	A,B,N
		at.Alley Spring		c,m	12	
Spring R.	*	Waco		c,m	12	T,N

Waterbody		Location	Agency	Coverage	Freq.	Comments
		Crestline	KDHE	c,m		
Lost Cr.	*	Seneca		c,m	6	B,N
Blue R.		Stanley,Ks.	KDHE	c,m	12	
Indian Cr.		Overland Pk.,Ks.	KDHE	c,m	12	
		Leewood,Ks.	KDHE	c,m	12	
Perche Cr.		McBaine		c,m	3	
Cedar Cr.		Columbia		C		
		Ashland		c,m	12	
L.Sac R.		Walnut Grove	DNR-GS	c,m	6	P
Tebo Cr.		Leesville		c,m	12	
M.Fk.Tebo Cr.		Leeton		c,m	12	
W.FkTebo Cr.		Lewis	USGS	c,m	12	
Dry Cr.		Devil's Elbow		c,m	3	
Meramec R.		Paulina Hills	DNR-GS	c,m	12	P,N,T
		Fenton	StL.Co.Water	c,m	12+	
Crooked Cr.		Dillard		M	12	
Big Cr.		Chloride		M	12	
Wilson's Cr.		Brookline	DNR-GS	c,m	6	P
		Battlefield	City of Spd.	c,m	12+	
James R.		Several	City of Spd.	c,m	12+	
James R.		Boaz	DNR-GS	c,m	6	P,T
Fall Cr.		Branson				
Roark Cr.		Branson				
Other Taney tribs.		Branson				
Main Ditch		Neelyville		c,m	12	
Center Cr.		Carterville		c,m	12	
	*	Smithfield		c,m	12	N,T
Turkey Cr.	*	Joplin		c,m	6	P,N,T
		Smithfield		c,m	12	
Short Cr.		Galena, Ks.		c,m	12	
Shoal Cr.	*	ab.Joplin		c,m	12	B,N
	**	ab.Capps Cr.	DNR-CC	c,m	12	B,N
		Galena, Ks.	KDHE	c,m	12	

Waterbody		Location	Agency	Coverage	Freq.	Comments
L.Sugar Cr.		Caverna		c,m	12	
Elk R.	**	Tiff City	DNR-CC	C	12	B,N,T
Indian Cr.	**	Ginger Blue	DNR-CC	C	12	B,N
Big Sugar Cr.	**	bl.Mikes Cr.	DNR-CC	C	12	B,N
LSugar Cr.	**	Pineville	DNR-CC	C	12	B,N
Buffalo Cr.	**	Tiff City	DNR-CC	C	12	B,N
Capps Cr.	*	nr. Mouth		C,	12	B.N
Upper Huzzah & tribs				c,m	3	
Upper Courtois & tribs				c,m	3	
Indian Cr.				c,m	3	
Neals Cr.				c,m	3	
Strother Cr.				c,m	3	
Brushy Cr.				c,m	3	
W.Fk.Black R.				c,m	3	
Bills Cr.				c,m	3	
Bee Fk.				c,m	3	
Logan Cr.				c,m	3	
Knob Cr.				c,m	3	

Element 2. Fish Tissue/Semi-Permeable Membrane Device Monitoring for Bioaccumulative, Trace Substances

Waterbody Location	Coverage	Freq.	Comments
* Mississippi River at Caruthersville	soc,m	1	B
* Mississippi River at Grafton, Ill.	soc,m	1	B,T
* Mississippi River At Hannibal, Mo.	soc,m	1	B
** Mississippi River at Thebes, Ill.	soc,m	1	B,T
** Missouri River at St. Joseph, Mo.	soc,m	1	B,T
* Missouri River at Hermann, Mo.	soc,m	1	B,T
** Platte River nr. Platte City, Mo.	soc,m	1	B
** Grand River at Brunswick, Mo.	soc,m	1	B,T
* S.Fabius River at Taylor, Mo.	soc,m	1	B,T
* Blue River nr. mouth (KC)	soc,m	1	P,N

Waterbody Location	Coverage	Freq.	Comments
** Osage River at St. Thomas	soc,m	1	B,T
** Gasconade River at Jerome	soc,m	1	B,T
* Meramec River at Sullivan	soc,m	1	A,B,T
* Meramec River at Paulina Hills	soc,m	1	P,N
* Big River nr. Richwoods	soc,m	1	N
* James River nr. Boaz	soc,m	1	P,N
** Little Sac River nr. Morrisville	soc,m	1	P
**Current River nr. Doniphan	soc,m	1	A,B,T
* Black River near Annapolis	soc,m	1	P
** Little River ditches nr. Rives	soc,m	1	B,T
* Center Creek nr Smithfield, Mo.	soc,m	1	N
* Lake Taneycomo near Powersite Dam	soc,m	1	B,T
* 4-6 additional sites that would be rotated annually among other streams or lakes in the state.			

Element 3. Ambient Sediment Chemistry Monitoring

Waterbody Location	Coverage	Freq.	Comments
* Mississippi R. at Cannon NWR	soc,m	1	B
* Mississippi R. at Riverlands EDA	soc,m	1	B
* Mississippi R. at St. Louis	soc,m	1	P,N
* Mississippi R. at Cape Girardeau	soc,m	1	B
* Mississippi R. at Caruthersville	soc,m	1	B
* Missouri R. nr. Bob Brown CA	soc,m	1	B
* Missouri R. at Kansas City	soc,m	1	P,N
* Missouri R. below Weldon Spring	soc,m	1	B
* Blue River at Kansas City	soc,m	1	P,N
*Grand River nr. Sumner,Mo.	soc,m	1	B
*Locust Cr. at Fountain Grove CA	soc,m	1	B
* Platte River at Platte City, Mo.	soc,m	1	B
* S.Fabius River at Taylor,Mo.	soc,m	1	B
* Creve Coeur Lake, St. Louis	soc,m	1	N
* Gasconade River at Jerome	soc,m	1	A,B

Waterbody Location	Coverage	Freq.	Comments
* Meramec River at Sullivan	soc,m	1	A,B
* Crooked Creek below Buick smelter	soc,m	1	P
* Meramec River at Paulina Hills	soc,m	1	P,N
* Big River nr. Richwoods	soc,m	1	N,
* L. Sac Arm, Stockton Reservoir	soc,m	1	P
* James River at Boaz	soc,m	1	P,N
* James R. Arm, Table Rock Reservoir	soc,m	1	P,N
* Current River at Doniphan	soc,m	1	A,B
* upper Clearwater Reservoir	soc,m	1	N
* upper Wappapello Reservoir	soc,m	1	N
* Big Creek below Asarco smelter	soc,m	1	P
* Little River ditches at Rives	soc,m	1	B
* Center Creek nr Smithfield,Mo.	soc,m	1	N
* Turkey Creek at Joplin	soc,m	1	P,N
* Elk River at Tiff City	soc,m	1	B
* 4-6 additional sites that would be rotated annually among other streams or lakes in the state			

KEY:

Coverage

c = Conventional chemical monitoring (water temperature, pH, specific conductance, dissolved oxygen, major ions, nitrogen, phosphorus, suspended solids, hardness, iron and bacteria).

m = Heavy metals.

soc = Synthetic organic chemicals (PAHs, PCBs, pesticides, volatiles).

Comments

A = High quality site, data collection to enforce Antidegradation Policy in Water Quality Standards.

B = Establish background water quality information

P = Assess impact of one or more point source discharges.

N = Assess impact of nonpoint sources(s).

R = Nutrient monitoring for Table Rock Lake.

T = Analyze for long term water quality trends.

Groundwater Monitoring

There would be two major components of the groundwater monitoring program. One, a network of wells of known depth and construction for water quality monitoring, and addressing such issues as suitability for drinking water and movement of saline-freshwater interface. Two, a network of wells measuring water levels and addressing issues such as rate of recharge, regional aquifer depletion (i.e., the Roubidoux in SW Missouri and NE Oklahoma), and profundity of cones of depression at sites like Springfield, Branson and Mexico. Both of these networks would cover all major potable aquifers in the state. Much water quality data is already available through ongoing monitoring by DNR/PDWP of public wells. A series of 50 wells would be added to the system, in cooperation between WPCP, PDWP, and DGLS. Semi-permeable membrane devices (SPMDs) would be used in a trial mode as part of this monitoring and if found appropriate, continued as a new tool for routine monitoring.

Surface Water Quantity Monitoring

This element of the monitoring strategy would upgrade the present flow monitoring network, to allow for additional monitoring at 20 sites. Presently, there are approximately 100 locations in the state where the USGS maintains instantaneous flow recording equipment. This proposal would allow flow monitoring to occur at locations that are critical for providing drinking water supplies as well as monitoring flow conditions and long term changes where significant water withdrawals occur or may occur, and in areas of interstate concern. The selection of these sites will be coordinated with PDWP and DGLS.

Biological Monitoring

In 1992 the Department of Natural Resources began a systematic sampling of the aquatic macroinvertebrate communities of 45 reference streams. These reference streams were picked because of the relatively good condition of the watershed they drained, the presence of a stable, permanently vegetated riparian zone and an absence of point source wastewater discharges. Sampling of these sites and selected sites with water quality or habitat impacts will lead to development of numeric biological water quality criteria within our water quality standards in three to five years.

When biological criteria are in place the department would add a few more reference streams and about 100 other stream locations across the state and begin a fixed station network of biological monitoring sites. These sites will be divided on an area proportional basis between the four ecoregions of the state prairie, prairie-ozark transition, ozark plateau, Mississippi Embayment. As a start, these new sites would be paired with new stations proposed for fixed station chemical monitoring.

The present reference sites are:

Prairie Ecoregion:

1. White Cloud Cr - Nodaway Co.
2. Honey Cr. - Nodaway Co.
3. E. Fk. Grand R. - Worth Co
4. Grindstone Cr. - DeKalb Co.
5. Long Br Platte - Nodaway Co.
6. W. Fk. Big Cr. - Harrison Co.
7. Marrowbone Cr. - Davies Co.
8. No Creek - Livingston Co.
9. W. Locust Cr. - Sullivan Co.
10. Spring Cr. - Adair Co.
11. E.Fk. Crooked R. - Ray Co.
12. Petit Saline Cr. - Cooper Co.
13. Burris Fk. - Moniteau Co.
14. L. Drywood Cr. - Vernon Co.
15. Middle Fabius R. - Lewis Co.
16. North R. - Marion Co.

Prairie-Ozark Transition:

17. Cedar Cr.-Cedar Co.
18. Pomme de Terre R.-Polk Co.
19. Deer Cr.-Benton Co.
20. L. Niangua R.-Hickory Co.
21. L. Maries R.-Maries Co.
22. Loutre R.-Montgomery Co.

Ozark Plateau:

23. Big Sugar Cr. - McDonald Co.
24. Bull Cr. - Taney Co.
25. Spring Cr. - Douglas Co.
26. North Fork R. - Douglas Co.
27. Jack's Fork - Shannon Co.
28. Sinking Cr. - Shannon Co.
29. Big Creek - Shannon Co.
30. L. Black R. - Ripley Co.
31. West Piney Cr. - Texas Co.
32. L. Piney Cr. - Phelps Co.
33. Meramec R. - Crawford Co.
34. Huzzah Cr. - Crawford Co.
35. Marble Cr. - Iron Co.
36. Boeuf Cr. - Franklin Co.
37. E.Fk. Black R. - Reynolds Co.
38. Sinking Cr. - Reynolds Co.
39. Rives aux Vases - Ste.Gen. Co.
40. Saline Cr. - Ste.Gen. Co
41. Apple Cr. - Cape G. Co.
42. L. Whitewater R. - Cape G. Co.

Mississippi Embayment:

43. Huffstetter Lateral Ditch - Stoddard Co.
44. Ash Slough Ditch - New Madrid Co.
45. Maple Slough Ditch - Mississippi Co.

Sites that have been sampled as part of the biocriteria development process that will probably be retained as fixed station biomonitoring sites include:

46. Clear Creek - Vernon Co.
47. McCarty Cr. - Vernon Co.
48. Horse Cr. - Cedar Co.
49. Brush Cr. - St. Clair Co.
50. N. Blackbird Cr. - Putnam Co.
51. E. Locust Cr. - Putnam Co.
52. W. Locust Cr. - Putnam Co.

The remainder of the sites must be evaluated in the field for suitability for this type of sampling and cannot be chosen at this time.

Beginning in 2001, DNR and MDC will begin a state-wide biomonitoring program for fish and aquatic macroinvertebrate communities. The program will monitor between 50 and 100 stream sites per year and will also measure the quality of the physical habitat of the stream site and collect some basic water chemistry data. About one-third of the sites will be randomly selected and the remainder will be selected based on potential or documented water quality concerns.

Special Studies

1. Wasteload Allocation Studies: DNR usually conducts 1 or 2 such studies each year. The results are used to develop a Qual 2e water quality model for a specific wastewater discharge and receiving stream and the model is then used to develop water quality based NPDES permit limits for the discharge. No expansion of this type of study is proposed.

2. Water Quality Studies of Specific Point and Nonpoint Sources: the Water Pollution Control Program usually conducts 3-4 abbreviated chemical studies per year to check on the status of streams below significant point or nonpoint sources to see if water quality standards are being met. This proposal would add an additional 2-3 studies per year to be performed by ESP personnel.

3. Large River Studies: None are presently being done. This proposal would request three such studies.

    a. Impacts of wastewater discharges on the lower 22 miles of the Meramec River.

    b. Delineation of mixing zones and water quality impacts of the Bissel Point and Lemay wastewater discharges on the Mississippi River.

    c. Impacts of the KC metro area discharges on the Missouri River.

4. Eutrophication of Ozark Lakes. The University of Missouri is presently under contract to DNR to make a detailed study of Table Rock Lake and its tributaries, to characterize the degree of eutrophication, identify limiting nutrient(s) and construct a nutrient budget for the lake. This study would lay the foundation for any rule changes the department might undertake to mitigate eutrophication in this reservoir. This proposal recommends that this same type of study be extended to all large reservoirs on a consecutive basis, with each study of 3-5 years duration. Reservoirs to be studied would include: Lake of the Ozarks, Bull Shoals, Norfolk, Clearwater, Wappapello, Stockton and Pomme de Terre reservoirs.

Screening Level Data Collection

The Department of Natural Resources uses a variety of data sources as initial indications of water quality that may require more sophisticated monitoring to quantify. This rudimentary form of monitoring data is referred to as "screening level data".

The major sources are:

1. Inspections and complaint investigations by DNR, MDC or other agencies.

2. Rapid stream assessments made by DNR/WPCP.

3. Data submitted by trained volunteers:
   a. DNR/UMC lake volunteer monitoring program.
   b. DNR/MDC stream water quality monitoring program.

4. Miscellaneous reports.
   No expansion in this type of data collection is proposed.

BUDGET

FIXED STATION NETWORK

Surface Water Chemistry	
27 new sites 6 or 12 collections/yr. @ $10,000/site	270,000
upgrade 6 SW Missouri sites @ $9,000/site	54,000
(contracted to USGS or private contractor)	
Surface Water Flow Monitoring	
20 new sites @ $6,000 initial installation/site	120,000
20 sites @ $2,000 annual cost/site	40,000
(contracted to USGS)	
Bioaccumulation of Toxics	
fish collection 15 additional sites/yr. @ $400/site	6,000
analysis 15 addn. composites for dieldrin series, PCBs, lead, mercury, cadmium @ $600/sample and evaluation of SPMD for inclusion in ambient monitoring plans	9,000
(0.35 FTE expansion ESP/FS section)	

Sediment Chemistry	
35 sites, 1 collection/yr. @ $300/site	10,500
analysis of 35 samples for heavy metals, dieldrin series, PCBs, PAHs, commonly used pesticides, and microtox screen for sediment toxicity @ $1050/sample	36,750
(0.35 FTE expansion ESP/FS section)	
Bacteria	
sample collection at estimated 15 new sites, sampled 20 times/yr.	12,500
collection of 10 addn. samples/yr. at each of 30 existing sites	12,500
analysis of 600 samples @ $30/sample	18,000
(0.40 FTE expansion ESP/FS or regional office)	
Groundwater Quality	
collection of water samples from 50 wells four times/yr.	20,000
(0.10 FTE expansion ESP/FS or regional offices)	
analysis of 200 groundwater samples for major ions, heavy metals, bacteria, nitrate-N, common herbicides @ $350/sample	140,000
(0.20 FTE expansion ESP/FS or regional offices)	
Groundwater Levels/Aquifer studies	
measurement of 50 wells four times per year	20,000
(0.10 FTE expansion DGLS)	
Biological Monitoring (Aq. Invertebrates)	
2.0 FTE expansion in ESP/FS section	110,000
additional water quality support monitoring	10,000
SPECIAL STUDIES	
Water Quality Studies of Discrete Point/NPS Areas	
0.25 FTE expansion in ESP/FS section, E&E, analytical costs	30,000
One large river study per year	
0.30 FTE expansion in ESP/FS section, E&E, analytical costs	50,000

Eutrophication of Lakes Annual grant to Univ. of Missouri	50,000
Total maximum daily load (TMDL) analyses in addition to special studies noted above 0.5 FTE expansion in WPCP, E&E, analytical costs	70,000
Ambient toxicity of streams using sensitive indicator organisms to establish conditions and trends before widespread toxicity becomes apparent	10,000

APPENDIX L

Section 319 Funding and the Clean Lakes Program

SECTION 319 FUNDING AND THE CLEAN LAKES PROGRAM

Introduction

In 1972, the Clean Lakes Program, a federal grant program, was established as section 314 of the Clean Water Act. The purpose of this program was to provide financial and technical assistance to States for restoration and protection of publicly owned lakes. Program activities were directed at diagnosing the condition of lakes and their watersheds, determining the extent and sources of pollution, developing feasible lake restoration and protection plans (Phase I Diagnostic/Feasibility Studies), implementing plans (Phase II Restoration/Protection Implementation Projects), and evaluating the longevity and effectiveness of various restoration and protection techniques (Phase III Post Implementation Monitoring studies). In addition, Clean Lakes Program funding could be used for statewide assessments of lake conditions (Lake Water Quality Assessment grants) and for the development of institutional and administrative capabilities to carry-out lakes programs.

Between 1976 and 1994 the Clean Lakes Program provided approximately $145 million of national funding to address lake problems, but there have been no appropriations for the program since 1994. July, 1998 USEPA guidance states that Section 319, Nonpoint Source Program funding can be used to fund Clean Lakes projects. In order to be eligible for funding, lake and reservoir management needs must be clearly identified in each state's Nonpoint Source Management Plan as well as eligible management practices.

Lake and Reservoir Pollution Control

Water Quality Standards promulgated to protect Missouri's waters for designated uses form the basis for pollution control efforts for lakes and reservoirs. All lakes in Missouri that are considered to be "waters of the state," those not entirely confined and located completely on lands owned, leased or otherwise controlled by a single person or by two or more persons jointly or as tenants in common, are protected by the general criteria and antidegradation provisions of the Water Quality Standards. The general criteria prohibit conditions that include aesthetic problems due to suspended or deposited material, discoloration, odor or conditions harmful to aquatic life. The antidegradation requirements prohibit lowering of water quality unless such action is an economic or social necessity to the state. In addition, 415 classified lakes are covered by numeric criteria. Classified lakes include any lake that falls into one of the following three categories: (1) small public drinking water reservoirs; (2) large multi-purpose reservoirs; and (3) reservoirs or lakes with important recreational values. In Missouri, the primary sources of lake and reservoir impairments are sediment, pesticides, and nutrients (see 303(d) list, Appendix F).

Restoration and Management Techniques

Effective and appropriate Best Management Practices should be implemented to the extent possible in the watersheds of lakes and reservoirs impaired by nonpoint source pollution. Sources of pollution must be managed sufficiently, in some cases on a periodic or continuing basis, to assure that the pollution being remediated will not recur. Some lakes may require the

implementation of in-lake management techniques in order to correct the impacts of past pollution. In-lake management techniques which had been funded under Section 314 can now be funded under Section 319 in the context of an appropriate Clean Lakes project (e.g. Phase II Restoration/Protection Implementation Projects). The following in-lake management techniques are eligible for Section 319 funding:

Phosphorus Inactivation
Dredging
Dilution and Flushing
Artificial Circulation
Hypolimnetic Aeration
Hypolimnetic Withdrawal
Sediment Oxidation
Biomanipulation
Algicides
Water Level Drawdown
Shading and Sediment Covers
Biological Controls (Fish, Insects)
Harvesting/Planting
Herbicides
Limestone Addition to Lake Surface
Injection of Base Materials into Lake Sediment
Mechanical Stream Doser
Limestone Addition to Watershed
Pumping of Alkaline Groundwater

Other projects that Section 314 funded that may now be funded through Section 319 include statewide lake assessments and lake volunteer monitoring programs.

REFERENCES

U.S. Environmental Protection Agency, 1990, The Lake and Reservoir Restoration Guidance Manual. EPA-440/4-90-006. Office of Water (WH-553), Washington, DC.

Wayland, III, Robert H. Memo to EPA Regional Water Division Directors and State and Interstate Water Quality Program Directors. 9 July 1998.